551.573
U58
W4Wr

W.B. No. 628.

U. S. DEPARTMENT OF AGRICULTURE
WEATHER BUREAU
CHARLES F. MARVIN, Chief

DEC 14
UNIV. OF MICH.
LIBRARY

MONTHLY WEATHER REVIEW

VOLUME 45, No. 9

SEPTEMBER, 1917

WASHINGTON
GOVERNMENT PRINTING OFFICE
1917

SEPTEMBER, 1917.

CONTENTS.

	Page.
INTRODUCTION	439
SECTION I.—AEROLOGY:	
Solar and sky radiation during September, 1917. I. F. Hand.	440
Döppler's principle for a windy atmosphere. H. Bateman.	441
Propagation to great distances of the sound of cannonade at the front. G. Bigourdan. (Abstract)	442
Accoustic efficiency of fog-signal machinery. L. V. King. (Abstract)	442
Surface currents of Jupiter. S. Bolton. (Abstract)	443
Effect of terrestrial relief on ionic densities in the atmosphere. P. L. Mercanton. (Abstract)	443
Observations of atmospheric electricity during the total solar eclipse on October 10, 1912, at Boã Vista, Brazil. W. Knoche and J. Laub. (Abstract)	443
Release of radium emanation from water at diffierent temperatures. J. Moran. (Abstract)	443
Absorption bands of atmospheric ozone in the spectra of sun and stars. A. Fowler and Hon. A. J. Strutt. (Abstract).	443
SECTION II.—GENERAL METEOROLOGY:	
Some temperature correlations in the United States. T. A. Blair. (8 figs.)	444
Rainfall and gunfire. A. Angot. (Abstract)	450
Bird migration in central Switzerland in relation to meteorological conditions. K. Bretscher. (Abstract)	451
Some nuclei of cloudy condensation. J. Aitken. (Abstract).	452
Condensation and evaporation of gas molecules. I. Langmuir. (Abstract)	452
Computation and measurement of the complex molecules of some vapors, according to the new condensation theory. L. Andrén. (Abstract)	452
A new evaporation formula. R. E. Horton. (Abstract)	453
Forests and rainfall experiments	453
Excessive precipitation in London. H. R. Mill. (Abstract).	453
Revolving fluid in the atmosphere. Sir N. Shaw. (Abstract)	454
Motion of a particle on the surface of a smooth rotating globe. F. J. W. Whipple. (Abstract)	454
Motion of the air in the lowest layers of the atmosphere. G. Hellmann. (Abstract)	454
Relation between pressure-gradient wind and friction in steady motion. F. Åkerblom. (Abstract)	455
Formation of anticyclonic stratus. C. K. M. Douglas. (Abstract)	455

	Page.
SECTION II.—GENERAL METEOROLOGY—Continued.	
Windward Islands versus Leeward Islands. (fig.)	455
Canadian astronomical appointments. (Reprinted)	456
SECTION III.—FORECASTS:	
Forecasts and warnings for September, 1917. H. C. Frankenfield. (Charts II and III)	457
SECTION IV.—RIVERS AND FLOODS:	
Rivers and floods during September, 1917. A. J. Henry. (Chart I)	462
Great Lakes levels during September, 1917	462
SECTION V.—SEISMOLOGY:	
Seismological reports for September, 1917. W. J. Humphreys	463
Late seismological reports	466
Seismological dispatches	467
SECTION VI.—BIBLIOGRAPHY:	
Recent additions to the Weather Bureau library. C. F. Talman	468
Recent papers bearing on meteorology and seismology. C. F. Talman	469
SECTION VII.—WEATHER AND DATA FOR THE MONTH:	
Weather of September, 1917. P. C. Day	470
Weather conditions over the North Atlantic during September, 1916 (with Chart IX)	471
Condensed climatological summary	473
Tables—	
Description	473
I. Climatological data for United States Weather Bureau stations	474
II. Accumulated amounts of precipitation	477
III. Data furnished by the Canadian Meterological Service	479
Charts—	Charts.
I. Hydrographs, September, 1917	87
II. Tracks of centers of HIGHS	88
III. Tracks of centers of LOWS	89
IV. Departures of mean temperatures	90
V. Total precipitation for the month	91
VI. Percentage of clear sky	92
VII. Sealevel isobars and isotherms, and prevailing winds	93
VIII. Total snowfall for the month	Not charted.
IX. Marine meteorological data for September, 1916	94

NOTICE TO CONTRIBUTORS.

Contributions intended for publication in any given issue of the MONTHLY WEATHER REVIEW (e. g., January) should be in the hands of the editor before the end of the next following month (e. g., February), if no illustrations are required. When the paper is illustrated, the manuscript and the copy for illustrations must be submitted much earlier, in order to permit copy being prepared for the engraver by the end of the month.

REPRINTS are made up without covers in the original size and pagination of the REVIEW. They will not be furnished unless specifically REQUESTED WHEN THE MANUSCRIPT IS SUBMITTED.

MONTHLY WEATHER REVIEW

CLEVELAND ABBE, jr., Editor.

VOL. 45, No. 9
W. B. No. 628.

SEPTEMBER, 1917.

CLOSED NOV. 3, 1917
ISSUED DEC. 3, 1917

INTRODUCTION.

As explained in this Introduction during 1914, the MONTHLY WEATHER REVIEW now takes the place of the Bulletin of the Mount Weather Observatory and of the voluminous publication of the climatological service of the Weather Bureau. The MONTHLY WEATHER REVIEW contains contributions from the research staff of the Weather Bureau and also special contributions of a general character in any branch of meteorology and climatology.

SUPPLEMENTS TO THE MONTHLY WEATHER REVIEW are published from time to time.

The climatological service of the Weather Bureau is maintained in all its essential features, but its publications, so far as they relate to purely local conditions, are incorporated in the monthly reports "Climatological Data" for the respective States, Territories, and colonies.

Beginning August, 1915, the material for the MONTHLY WEATHER REVIEW has been prepared and classified as follows:

SECTION 1.—*Aerology.*—Data and discussions relative to the free atmosphere.

SECTION 2.—*General meteorology.*—Special contributions by any competent student bearing on any branch of meteorology and climatology, theoretical or otherwise.

SECTION. 3.—*Forecasts and general conditions of the atmosphere.*

SECTION 4.—*River and floods.*

SECTION 5.—*Seismology.*—Results of observations by Weather Bureau observers and others as reported to the Washington office.

SECTION 6.—*Bibliography.*—Recent additions to the Weather Bureau library; recent papers bearing on meteorology.

SECTION 7.—*Weather of the month.*—Summary of local weather conditions; climatological data from regular Weather Bureau Stations; tables of accumulated and excessive precipitation; data furnished by the Canadian Meteorological Service; monthly charts Nos. 1, 2, 3, 4, 5, 6, 7, 8, the same as hitherto; Meteorological Summary and chart No. 9 of the North Atlantic Ocean for this month in 1916. Owing to the fact that ocean meteorological data are frequently not available for a considerable time after the close of the month to which they relate, the chart and text matter in connection therewith appear one year late.

In general, appropriate officials prepare the seven sections above enumerated; but *all students of atmospherics are cordially invited to contribute such additional articles as seem to be of value.*

The voluminous tables of data and text relative to local climatological conditions, that during recent years were prepared by the 12 respective "district editors" are omitted from the MONTHLY WEATHER REVIEW, but collected and published by States at selected section centers in the monthly reports already mentioned.

The data needed in Section 7 can only be collected and prepared several weeks after the close of the month designated on the title-page; hence the REVIEW as a whole can only issue from the press within about eight weeks from the end of that month.

It is hoped that the meteorological data hitherto contributed by numerous independent services will continue as in the past. Our thanks are specially due to the directors and superintendents of the following:

The Meteorological Service of the Dominion of Canada.
The Meteorological Service of Cuba.
The Meteorological Observatory of Belén College, Habana.
The Government Meteorological Office of Jamaica.
The Meteorological Service of the Azores.
The Meteorological Office, London.
The Danish Meteorological Institute.
The Physical Central Observatory, Petrograd.
The Philippine Weather Bureau.

The Weather Bureau desires that the MONTHLY WEATHER REVIEW shall be a medium of publication for contributions within its field, but such publication is not to be construed as official approval of the views expressed.

CORRIGENDUM.

REVIEW, July, 1917.

Page 347, col. 1, Table 1, Southampton, L. I., should be described as 14 miles from Long Island Sound.

16340—17——1

SECTION I.—AEROLOGY.

SOLAR AND SKY RADIATION MEASUREMENTS DURING SEPTEMBER, 1917.

By IRVING F. HAND, Temporarily in Charge Solar Radiation Investigations.

(Dated: Washington, D. C., Nov. 3, 1917.)

For a description of instrumental exposures and an account of the methods of obtaining and reducing the measurements, the reader is referred to the REVIEW for January, 1917, **45**:2.

As noted in the REVIEW for May, 1917, the Marvin pyrheliometer in use at Santa Fe became defective about the beginning of that month, due to an accident. It has been replaced by Marvin silver-block pyrheliometer No. 2 and comparisons between the latter and Smithsonian silver-disk No. 1, made at Santa Fe in October, 1917, indicate that the two instruments are in accord. The Santa Fe data are therefore resumed with this issue.

The monthly means and departures from normal values given in Table 1 show that direct solar radiation averaged about normal at Santa Fe, N. Mex., above normal at Washington, D. C., and Madison, Wis., and below normal at Lincoln, Nebr.

Noon intensities of 1.49 at Washington, D. C., on the 11th and 1.45 at Madison, Wis., on the 10th exceed by about 3 per cent and 2 per cent, respectively, the previous noon intensities at those stations.

There were no half-day series which warranted extrapolation to zero air mass.

Table 3 shows a slight excess of radiation for the month at Madison and a decided deficiency at Washington.

Skylight polarization measurements made at Washington, D. C., on 6 days give a mean of 59 per cent with a maximum of 66 per cent on the 26th. The measurements obtained at Madison, Wis., on 7 days give a mean of 66 per cent with a maximum of 76 per cent on the 10th. This latter is unusually high but is comparable with the high direct radiation intensity obtained on that date.

TABLE 1.—*Solar radiation intensities during September, 1917.*

[Gram-calories per minute per square centimeter of normal surface.]

Washington, D. C.

Date.	Sun's zenith distance.									
	0.0°	48.3°	60.0°	66.5°	70.7°	73.6°	75.7°	77.4°	78.7°	79.8°
	Air mass.									
	1.0	1.5	2.0	2.5	3.0	3.5	4.0	4.5	5.0	5.5
A. M.	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*
Sept. 4	1.17									
7			0.90							
11	1.53	1.39	1.26	1.20	1.13	1.07	1.00	0.96		
12	1.44	1.25	1.09	0.98	0.89	0.82				
13	1.34	1.22	1.11	0.99	0.88	0.80	0.75	0.69	0.62	
17	1.43	1.28	1.17	1.07	0.98					
18	1.37	1.31	1.20	1.12	0.98	0.83	0.75	0.69	0.64	0.60
19		1.10	0.96							
22		1.32								
26		1.30	1.21	1.12	1.04					
Monthly means	1.38	1.27	1.11	1.08	0.98	0.88	0.83	0.78	(0.63)	(0.60)
Departure from 9-year normal	+0.05	+0.06	+0.03	+0.08	+0.08	+0.07	+0.11	+0.12	−0.03	−0.04
P. M.										
Sept. 11		1.40	1.29	1.20	1.13	1.07	0.98	0.91		
12		1.24	0.99	0.86	0.76	0.66	0.59	0.53	0.48	
17		1.30	1.14	1.00	0.91	0.84	0.79	0.74	0.68	
26		1.22	1.09	0.99	0.90	0.85	0.80	0.72	0.62	0.54
Monthly means		1.29	1.13	1.01	0.92	0.86	0.79	0.72	0.59	(0.54)
Departure from 9-year normal		+0.09	+0.06	+0.05	+0.04	+0.07	+0.04	−0.02	−0.13	−0.16

TABLE 1.—*Solar radiation intensities during September, 1917*—Contd.

Madison, Wis.

Date.	Sun's zenith distance.									
	0.0°	48.3°	60.0°	66.5°	70.7°	73.6°	75.7°	77.4°	78.7°	79.8°
	Air mass.									
	1.0	1.5	2.0	2.5	3.0	3.5	4.0	4.5	5.0	5.5
A. M.	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*
Sept. 10			1.33	1.25	1.18	1.11				
11		1.37	1.31	1.24	1.18					
21		1.25								
22		1.17	1.08	1.02	0.96					
24		1.20	1.08							
29			1.26	1.12						
Monthly means		1.25	1.21	1.16	1.11	(1.11)				
Departure from 8-year normal		±0.00	+0.07	+0.12	+0.13	+0.18				
P. M.										
Sept. 10		1.42	1.30	1.23	1.16					
11		1.37	1.29	1.23						
21		1.25	1.16	1.07	1.00					
22		1.20	1.02	0.87						
24		1.20	0.98	0.79		0.62				
28		1.27	1.20	1.07	0.94	0.84				
29		1.38								
Monthly means		1.30	1.16	1.04	1.03	(0.73)				
Departure from 8-year normal		+0.07	+0.05	+0.03	+0.04	±0.00				

Lincoln, Nebr.

A. M.										
Sept. 5				0.98	0.78	0.72				
7	1.36			1.07						
11		1.16								
13		1.13	1.07	0.91	0.82	0.74				
22		1.17	1.02	0.89	0.76					
23		1.24	1.15	1.07	0.97	0.86	0.80	0.73		
24				0.87	0.78	0.69	0.63			
27		1.31	1.13	0.99		0.86				
28		1.28	1.17							
29		1.36	1.30	1.24	1.16	1.08	1.03	0.97		
Monthly means	(1.36)	1.24	1.14	1.00	0.88	0.82	0.82	(0.85)		
Departure from 3-year normal	+0.01	−0.03	±0.00	−0.01	−0.06	−0.03	+0.04	+0.15		
P. M.										
Sept. 8			1.02	0.93	0.86	0.79	0.72	0.66		0.58
13		1.21	1.07	0.98	0.85	0.76	0.69			
17		0.92	0.77			0.53	0.48			
18			0.94		0.87					
21				0.69	0.61	0.56	0.45			
22		1.08	0.99	0.89	0.76					
23		1.19	1.07	0.94	0.83	0.74	0.66	0.60	0.56	0.52
27		1.33	1.25	1.17	1.10	1.03	0.97	0.91	0.86	
28		1.27								
29		1.39	1.31	1.24	1.18	1.11	1.06	1.00	0.95	0.90
Monthly means		1.20	1.05	0.98	0.88	0.79	0.72	0.79	0.79	0.67
Departure from 3-year normal		−0.07	−0.08	−0.07	−0.06	−0.08	−0.09	+0.01	+0.06	+0.02

TABLE 1.—*Solor radiation intensities during September, 1917*—Contd.

Santa Fe, N. Mex.

Date.	Sun's zenith distance.									
	0.0°	48.3°	60.0°	66.5°	70.7°	73.6°	75.7°	77.4°	78.7°	79.8°
	Air mass.									
	1.0	1.5	2.0	2.5	3.0	3.5	4.0	4.5	5.0	5.5
A. M.	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*
Sept. 3	.....	.....	.....	1.18	1.11	1.06	1.00	.....	.....	.....
4	.....	.....	1.21	.....	1.13	1.09	1.02	0.96	0.91	.....
5	.....	1.37	1.24	1.17	1.10	1.04	0.98	0.92	0.87	0.82
6	1.45	1.32	.....	.....	.....	.....	.....	.....	.....	.....
7	.....	.....	.....	1.13	1.06	1.01	0.93	0.86	0.79	.....
12	.....	1.39	1.34	1.30	1.08	1.00	.....	.....	.....	.....
13	.....	1.37	1.28	.....	.....	.....	.....	.....	0.95	0.91
15	.....	.....	.....	.....	1.21	1.18	1.14	1.10	1.03	0.91
19	.....	.....	.....	.....	1.17	1.06	0.97	0.86	.....	.....
22	.....	1.44	1.32	1.26	1.20	1.14	1.08	1.02	0.97	0.93
Monthly means	(1.45)	1.38	1.88	1.21	1.13	1.07	1.02	0.95	0.92	0.89
Departure from 5-year normal	−0.06	−0.03	−0.03	−0.04	−0.03	−0.04	−0.03	−0.06	−0.04	−0.03
P. M.										
Sept. 28	.....	1.52	1.48	1.36	1.29	1.21	1.15	.....	.....	.....
Monthly means	.....	(1.52)	(1.48)	(1.36)	(1.29)	(1.21)	(1.15)	.....	.....	.....
Departure from 5-year normal	.....	+0.02	+0.07	+0.05	+0.09	+0.07	+0.07	.....	.....	.....

TABLE 2.—*Vapor pressures at pyrheliometric stations on days when solar radiation intensities were measured.*

Washington, D. C.			Madison, Wis.			Lincoln, Nebr.			Santa Fe, N. Mex.		
Dates.	8 a.m.	8 p.m.	Dates.	8 a.m.	8 p.m.	Dates.	8 a.m.	8 p.m.	Dates.	8 a.m.	8 p.m.
1917.	*mm.*	*mm.*	1917.	*mm.*	*mm.*	1917.	*mm.*	*mm.*	1917.	*mm.*	*mm.*
Sept. 4	9.14	10.21	Sept.10	4.75	4.75	Sept.5	15.11	11.81	Sept.3	7.04	5.79
7	9.47	9.14	11	5.36	6.27	7	14.60	14.10	4	6.50	6.50
11	5.16	7.04	21	7.29	8.48	8	10.59	13.61	5	7.57	6.76
12	7.57	7.29	22	8.18	10.21	11	7.87	9.47	6	6.76	6.76
13	7.87	9.14	24	8.48	10.59	13	11.81	13.61	7	6.02	8.81
17	9.83	8.47	28	7.04	7.29	17	11.38	11.81	12	9.83	9.83
18	8.48	11.38	29	5.79	6.02	18	9.47	12.24	13	8.48	10.59
19	10.59	12.24	.....	.....	.....	21	9.83	9.47	15	4.75	5.56
22	10.97	7.87	.....	.....	.....	22	9.47	10.21	19	7.32	6.50
26	9.83	11.38	.....	.....	.....	23	7.87	9.14	22	7.32	6.76
						24	9.47	13.61	28	3.81	3.81
						27	5.79	6.50	.....	.....	.....
						28	5.16	7.29	.....	.....	.....
						29	6.27	5.16	.....	.....	.....

TABLE 3.—*Daily totals and departures of solar and sky radiation during September, 1917.*

[Gram-calories per square centimeter of horizontal surface.]

Day of month.	Daily totals.		Departures from normal.		Excess or deficiency since first of month.	
	Washington.	Madison.	Washington.	Madison.	Washington.	Madison.
1917.	*calories.*	*calories.*	*calories.*	*calories.*	*calories.*	*calories.*
Sept. 1	195	330	−217	−64	−217	−64
2	362	452	−47	61	−264	−3
3	352	267	−55	−121	−319	−124
4	505	471	100	86	−219	−38
5	380	233	−23	−150	−242	−188
6	113	477	−288	98	−530	−90
7	319	53	−80	−321	−610	−411
8	50	429	−348	60	−958	−351
9	117	92	−279	−274	−1,237	−625
10	400	549	5	187	−1,232	−438
11	569	554	176	196	−1,056	−242
12	526	383	135	29	−921	−213
13	456	197	67	−152	−854	−365
14	238	403	−150	58	−1,004	−307
15	101	349	−285	7	−1,289	−300
16	273	413	−111	74	−1,400	−226
17	506	394	124	58	−1,276	−168
18	454	417	75	84	−1,201	−84
19	436	258	59	−71	−1,142	−155
20	337	99	−37	−226	−1,179	−381
Decade departure	.....	.....	.....	.....	53	57
21	316	436	−56	114	−1,235	−267
22	432	429	63	111	−1,172	−156
23	303	422	−64	107	−1,236	−49
24	216	414	−148	103	−1,384	54
25	243	394	−118	86	−1,502	140
26	429	94	71	−210	−1,431	−70
27	409	412	54	112	−1,397	42
28	208	419	−143	123	−1,520	165
29	336	412	−12	120	−1,532	285
30	435	310	91	22	−1,441	307
31	.....	.....	.....	.....	.....	.....
Decade departure	.....	.....	.....	.....	−262	688
Excess or deficiency since first of year. {calories	.....	.....	.....	.....	−5,981	1,680
Excess or deficiency since first of year. {per cent	.....	.....	.....	.....	−5.6	1.6

DÖPPLER'S PRINCIPLE FOR A WINDY ATMOSPHERE.

By HARRY BATEMAN, Ph. D.

[Dated: 730 South Lake Avenue, Pasadena, Cal., Oct. 15, 1917.]

In view of the interest which is being taken in the effect of wind on the propagation of sound it may be worth while to recall the form which Döppler's principle assumes when a wind is blowing.

If the observer is moving with velocity u, the source of sound with velocity v, and the wind with velocity V, all measured in the same direction, then in the case of sound waves moving in the opposite direction and originating at the source with frequency ν the observed frequency is

$$\nu_0 = \nu \frac{c - V + u}{c - V + v} \qquad (1)$$

where c is the velocity of sound in still air.

This result may be obtained with the ordinary form of Döppler's principle either by reducing the air to rest by substracting the wind velocity V from u and v, or by regarding the velocity of sound in the moving air as $c - V$.

To prove the formula analytically let us neglect the variation of air-density and wind-velocity with altitude and assume that the wind is blowing steadily in a direction parallel to the axis of x with velocity V, then the velocity potential ϕ of sound waves propagated through the air satisfies the partial differential equation.[1]

$$\left(\frac{\partial}{\partial t} + V\frac{\partial}{\partial x}\right)^2 \phi = c^2 \nabla^2 \phi.$$

This equation may be transformed into the ordinary wave-equation for still air by writing x' in place of $x - Vt$. The solution corresponding to sound from a moving source which is at the point $\xi(\tau)$, $\eta(\tau)$, $\zeta(\tau)$ at time τ is

$$\phi = \frac{1}{\gamma} f(\tau)$$

where τ is defined by the equation

$$[x - \xi(\tau) - V(t - \tau)]^2 + [y - \eta(\tau)]^2 + [z - \zeta(\tau)]^2 = c^2 (t - \tau)^2,$$

and γ is the partial derivative of the left-hand side with respect to τ.

Putting

$$x = a + ut,\ y = 0,\ z = 0,\ \xi(\tau) = \alpha + v\tau,\ \eta(\tau) = 0,\ \zeta(\tau) = 0,$$

where a, α, u, v, are constants so as to have the case of a source and observer moving along the same straight line with different constant velocities, we find that

$$\tau = \frac{t(u - v \pm c) + a - \alpha}{v - V \pm c}$$

For sound of frequency ν we may write $f(\tau) = A\sin(\nu\tau + \epsilon)$ and the observed frequency is seen to be given by formula (1). The wave-length is also

$$\lambda_0 = \frac{2\pi}{\nu}(\pm c - V + v)$$

It should be noticed that if $u = v$ the observed frequency is the same as the natural frequency whatever be the velocity of the wind. If $v = V$ the observed wave-length is the same as the natural wave-length. In actual practice the horizontal wind velocity may be different at the locations of the source and observer owing to vertical motion of the air, eddy motion, and friction. An exact mathematical treatment of the general problem is difficult

[1] See, for instance, *S. Fujiwhara*, in Bull., Central meteorol. obs'y, Japan, Tokyo, (1912), 2, no. 1.

but if U is the wind velocity near the observer and V the wind velocity near the source of sound, the empirical formula

$$\nu_0 = \nu \frac{c - U + u}{c - V + v}$$

may be fairly accurate. It may be worth while to test this formula experimentally.

In the case of an overhead source of sound the theory is naturally complicated and is much more so when the variation of air density and wind velocity are taken into account. Experiments with sound produced in a moving aeroplane may indicate whether the above variations of atmospheric conditions with altitude have any appreciable effect on the observed frequency.

PROPAGATION TO GREAT DISTANCES OF THE SOUND OF CANNONADE AT THE FRONT.[1]

By G. BIGOURDAN.

[*Reprinted from* Science Abstracts, Sect. A, July 30, 1917, §657.]

A cannonade produces various noises from the mouths of the guns and from the explosions of the shells. Some of these noises can reach great distances, 200 to 300 kilometers, but it is not agreed how they reach them.

It is thus thought desirable to cite the case of an engineer, aged 52, totally deaf since the age of 6 through cerebrospinal meningitis. Placed at the side of a locomotive whistling, he perceived only a sudden pain of the drum skin, which ceased immediately in spite of the continuation of the whistling. For the last 20 years if within 1,000 to 1,500 meters of gunfire, he perceives two successive shocks—one transmitted by the earth, one by the air. The last affects the thorax particularly. At the commencement of the Somme offensive, from the outskirts of Paris, when attending [attentive?], he was conscious of vibration during the cannonade; sometimes he would perceive only dull blows, at others he would perceive something at the same instant as an ordinary hearer. The distance to the Somme front (120 kilometers) excluded entirely the route through the air, so it must be by the earth; and so also for the normal hearer, since both perceive it at the same time (see Science Abstracts, 1916, §1056).—*E. H. B[arton]*.

ACCOUSTIC EFFICIENCY OF FOG-SIGNAL MACHINERY.[2]

By L. V. KING.

[*Reprinted from* Science Abstracts, Sect. A, July 30, 1917, §655.]

The first section of this paper sketches the history of fog-signal experiments, dwelling specially on the work of Tyndall published in 1874 in a Trinity House report.

At about the same time experiments by Duane and by Joseph Henry were conducted, and were published in 1874. The result of fog-signal tests carried out in the United States to the year 1894 were published in Livermore's Report to the Lighthouse Board of that date.

In 1901 a committee of the Trinity House carried out, at the Isle of Wight, a series of tests under the scientific direction of Rayleigh and T. Matthews. For calm weather a low note (about 180 per second) was considered most suitable; when the wind was contrary and the sea rough, it was found that a higher note penetrated farther than a low one. The physical significance of this was discussed by Rayleigh at that time.[3] It appears surprising that while a blast is being sounded from a siren which can be heard about 8 miles away on a good day, energy is being expended at the rate of about 100 horsepower. The high note of a Scottish signal required 600 horsepower. Rayleigh raised the question as to whether these enormous powers are really utilized for the production of sound or whether from some cause, possibly avoidable, a large proportion may not be wasted.

The experience of French fog-signal engineers was summed up by C. Ribbière in 1908. This emphasized the desirability of obtaining further knowledge as to the efficiency of the fog-signal apparatus.

The second section deals with the production of sound by a special siren called the "diaphone," due in its present form to J. P. Northey. The essential feature of this apparatus is a hollow cylindrical piston, which is oscillated longitudinally by the "driving air," and so opens and closes ports which allow a series of puffs from the "sounding air." These puffs give a nearly pure tone of about 180 per second. This sound passes through a suitable horn.

The third section is occupied with the numerical relations between sound waves and their audibility as fog-signals.

The fourth section deals with the "phonometer" due to S. G. Webster. This consists of a Helmholtz hollow cylindrical resonating chamber, one end of which is pierced by a smooth hole communicating freely with the atmosphere, while the other has a very uniform plate of the best mica obtainable (such as is used in phonographs). The resonator is tuned to the pitch for which it is to be used as a detector, and the vibrations of the mica diaphragm are detected and measured as follows: The mica disk carries a sharp steel point firmly clamped at its center. A narrow steel strip is suitably held taut at both extremities in a fork capable of adjustment, and the strip has its center in contact with the steel point, so that a slight movement of the disk and point gives the strip a corresponding twist. This twist is detected by the movement of a beam of light reflected from a small concave mirror carried by the strip.

The diaphone may be worked backward and is then called the "phone" or standard generator. When its diaphragm is made to oscillate through a known amplitude it is possible to calculate the numerical characteristics of the spherical sound waves emitted. By the use of the "phone" and the "phonometer" the acoustic output of any sound generator of the same pitch (such as violin, cornet, or human voice) may be calculated.

Section five is on aerial sound waves of large amplitude and the discontinuity that may be expected to occur in their propagation. In the sixth section the thermodynamic estimate of acoustic efficiency is treated. By the use of resistance thermometers of iron wire one one-thousandth inch in diameter the temperature fall of the air, due to the conversion of the compressed air energy into sound, was measured in the diaphone.

Section seven deals with the actual fog-signal experiments carried out near Quebec in 1913. The acoustic efficiency of the diaphone in one case was found to be nearly 6 per cent, in another a little over 8 per cent. Using his phonometer A. G. Webster had previously found the violin, the cornet, and the human voice to have acoustic efficiencies of about 0.05 per cent, 0.1 per cent, and 1 per cent, respectively.

---

[1] Comptes Rendus, Paris, Oct. 2, 1916, 163: 323-324.
[2] Jour., Franklin Inst., Philadelphia, Mar., 1917, 183: 259-286.
[3] Phil. Mag., 1903, 6: 289-305.

An eighth section deals with future problems in acoustic engineering. The paper is chiefly descriptive and includes many clear diagrams and other illustrations. Full details of the tests are to be published elsewhere shortly.—*E. H. B[arton]*.

SURFACE CURRENTS OF JUPITER.[4]

By S. BOLTON.

[*Reprinted from* Science Abstracts, Sect. A, Aug. 30, 1917, §743.]

A table is given showing details of phenomena observed on Jupiter during the apparition of 1916–17 with a 26-inch reflector, and a drawing indexed so that any feature can be readily recognized. The quickened rate of the equatorial current was quite abnormal, the period being 7.7 seconds shorter than during the last apparition (1915–16). The white and dark spots fringing the north edge of the north equatorial belt exhibited two separate rates of motion. With regard to the color of the planet the author confirms the observations of Lowell and Antoniadi on the cherry-red hue of the belts and poles.—*C. P. B[utler]*.

EFFECT OF TERRESTRIAL RELIEF ON IONIC DENSITIES IN THE ATMOSPHERE.[5]

By P. L. MERCANTON.

[*Reprinted from* Science Abstracts, Sect. A, July 30, 1917, §662.]

It is known that the ratio of positive to negative ionic charge densities is greater at elevated points on the earth's surface than at lower levels. The experiments here described were made at the Tour de Gourze, near Lausanne, which stands at the summit of a hill 930 meters above sealevel. The ionic charges were measured by means of an Ebert apparatus charged to 50—240 volts, which would thus catch only the more mobile ions. The potential gradient at the top of the tower attained 1,200 volts/meter and here the ratio E_+/E_- was found to be much above unity; in one case E_- was zero. Within the tower where the potential gradient was zero E_+ was approximately equal to E_-.—*J. S. D[ines]*.

OBSERVATIONS OF ATMOSPHERIC ELECTRICITY DURING THE TOTAL SOLAR ECLIPSE ON OCTOBER 10, 1912, AT BOA VISTA, BRAZIL.[6]

By W. KNOCHE and J. LAUB.

[*Reprinted from* Science Abstracts, Sect. A, July 30, 1917, § 663.]

Observations or records of the following were obtained for periods from October 2 to 11: Hertzian waves, radioactive content of air, fall of potential, conductivity (both + and −), positive and negative charge, number of ions (+ and −). Throughout the eclipse the sun was completely obscured by clouds, and the meteorological elements scarcely changed, so that it is supposed that the results obtained are independent of any indirect effect which might be produced by fluctuations of the meteorological elements.

The chief results produced by the eclipse were: The + and − charge, and the total number of ions showed a diminution followed by a recovery. The ratios of + to − charge, of + to − velocity of ions, and of + to − conductivity showed pronounced maxima, which occurred after the moment of totality. The + and − total conductivity and air-earth current showed minima shortly after the time of totality. (See Science Abstracts, 1917, No. 101).—*R. C[orless]*.

RELEASE OF RADIUM EMANATION FROM WATER AT DIFFERENT TEMPERATURES.[7]

By J. MORAN.

[*Reprinted from* Science Abstracts, Sect. A, July 30, 1917, § 645.]

This paper describes a study of the release of radium emanation from water by bubbling air through the radium solution at different temperatures, at a definite rate of flow of air. Observations were made with the temperatures of the solution at 16.5°, 20°, 30°, 60°, and 80°C., and the results show that the release of emanation is considerably increased as the temperature rises, naturally reaching an upper limit at 100°C.

It is proved that temperature is an important factor in the determination of RaEm by the bubbling method, and should be known and kept constant during an experiment.—*A. B. W[ood]*.

ABSORPTION BANDS OF ATMOSPHERIC OZONE IN THE SPECTRA OF SUN AND STARS.[8]

By Prof. A. FOWLER and Hon. A. J. STRUTT.

[Abstract of an address before the Royal Society, June 21, 1917.]

In this paper it is shown that a series of narrow bands in the ultra-violet absorption spectrum of ozone, appears in the spectra of the sun and stars near the extreme end of the photographic spectrum. The atmospheric origin of these bands is proved by the increase in their intensity in the solar spectrum as the sun's altitude is diminished. The observations are considered strongly to confirm the view of Hartley that ozone is the constituent of the atmosphere which limits the spectra of celestial bodies in the ultra-violet.

[4] Monthly Notices, Royal astron. society, March, 1917, 77:460–462.
[5] Terrestrial Magnetism, March, 1917, 22:35–37.
[6] Terrestrial Magnetism, Dec., 1916, 21:171–204.
[7] Trans., Roy. Soc. Canada, Sept., 1916, 10:57–64.
[8] *Reprinted from* Nature, London, July 5, 1917, 99:379.

SECTION II.—GENERAL METEOROLOGY.

SOME TEMPERATURE CORRELATIONS IN THE UNITED STATES.

By THOMAS ARTHUR BLAIR, Observer.

[Dated: Weather Bureau, Salt Lake City, Utah, July 25, 1917.]

Introductory.

In recent years many meteorologists have noted the existence of characteristic seesaw variations in the weather at various widely separated places; an excess of temperature or precipitation in one part of the world occurs simultaneously with a deficiency in another part, or is followed after a definite interval by such deficiency. Most of the relations investigated have been seasonal, and it seems evident that they are connected with the more or less permanent areas of high and low pressure, which were named "centers of action" by Teisserenc de Bort, and that these in turn are affected by changes in the general circulation of the atmosphere induced by varying solar activity.

A recent paper by Craig [1] discusses such an inverse relation between the temperatures of Lower Egypt and southwestern England, and finds for the year a correlation coefficient of -0.43 ± 0.10, and for the first quarter of the year -0.72 ± 0.06. He determines the coefficients of correlation for various stations between Egypt and England with Cairo, and draws lines of equal correlation to fix the line where the relation changes from positive to negative. In addition to the theoretical bearing of such studies there is a popular interest in knowing to what extent an unusually dry or unusually cold period, for instance, in one section of the country is an indication of similar or of opposite conditions in other sections. In the present discussion the same method is employed in studying temperatures in the United States, and the following relationships are developed:

(1) There is a well-marked seesaw relation between the temperatures of southern California and of the southeastern United States for certain months of the year.

(2) For other months the temperatures vary independently.

(3) These changes in relationship are not wholly seasonal, but appear to have a wave-like oscillation in value.

(4) In consequence the coefficients expressing the annual temperature correlations have intermediate values.

(5) There is a definite daily correlation during the time of greatest monthly correlation.

January temperature relationships.

It is reasonable to expect that such interrelations would be most clearly defined in midwinter, when the contrasts between land and water temperatures and between tropical and extratropical temperatures are greatest. Accordingly in this paper the midwinter month of January is examined in most detail and is found to present the most marked relationships.

[1] *Craig, J. I.*, Seesaw of temperature between England and Egypt. Quart. Jour., Roy. met. soc., April 1915, 41: 89-98.

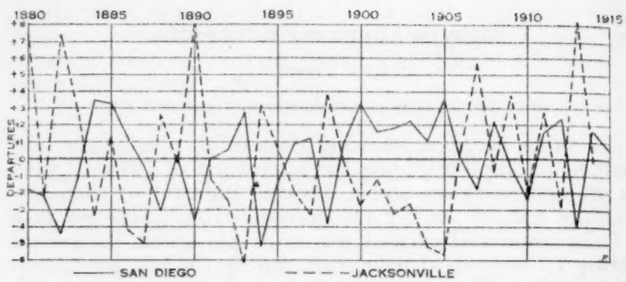


FIGURE 1.—Departures of the mean January temperatures from the normal, at San Diego, Cal., and Jacksonville, Fla., 1880-1914.

San Diego and other cities.—Considering first the January temperatures at San Diego, Cal., and Jacksonville, Fla., and using averages for the years 1880 to 1915, inclusive, we begin by plotting the departures, as shown in figure 1. This at once reveals a negative relationship between the two stations. The same data are presented in another form by the dot chart, figure 2. In this figure the abscissae of the dots, i. e., their distances to the right or left of the vertical line, are the departures from the mean at San Diego, and the ordinates, or distances above or below the horizontal line, are the departures at Jacksonville. It is apparent that a right diagonal through the second and fourth quadrants, represented by the equation $y = -x$, and corresponding to perfect negative correlation, would fit the facts fairly well. Since, at any rate, a straight line will evidently fit the conditions better than a curve of higher degree, let us assume the line to be represented by the general linear equation $y = a + bx$. Solving this for the most probable values of a and b, we get the equation $y = 0.04 - 1.16x$, represented by the line AB in figure 2. The solution is by the method of normal equations, developed in the theory of least squares, which will be briefly illustrated in Table 4, following.

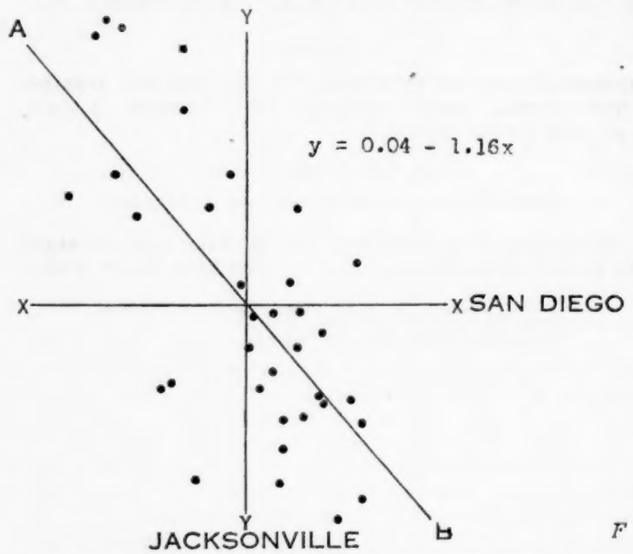


FIG. 2.—Dot chart of departures of the mean January temperatures from the normal, at San Diego (abscissae) and Jacksonville (ordinates).
Line A—B has equation: $y = 0.04 - 1.16x$.

This equation, with its constant term nearly equal to zero, and the coefficient of x nearly equal to 1, establishes a very definite relation between the January temperatures at San Diego and Jacksonville, but the most convenient expression of that relation is by means of a coefficient of correlation. In Table 1, which is the usual form of correlation table, familiar to readers of the REVIEW, the mean temperatures at the two stations are tabulated together with the departures, x and y, the squares of the departures, and the products of the departures. Using the equation,

$$r = \frac{\Sigma(xy)}{\sqrt{\Sigma x^2 \Sigma y^2}}$$

the coefficient of correlation, r, is found equal to $-0.707 \pm E_r$, signifying a rather high degree of negative correlation.

TABLE 1.—*Correlation of January temperatures between San Diego and Jacksonville, 1880 to 1915.*

Year.	San Diego, Cal.			Jacksonville, Fla.			xy
	Mean.	Departures. x	x^2	Mean.	Departures. y	y^2	
	°F.			°F.			
1880	52.8	−1.8	3.24	62.8	+7.4	54.76	−13.32
1881	52.5	−2.1	4.41	53.2	−2.2	4.84	+ 4.62
1882	50.3	−4.3	18.49	62.8	+7.4	54.76	−31.82
1883	53.6	−1.0	1.00	58.2	+2.8	7.84	− 2.80
1884	58.1	+3.5	12.25	52.0	−3.4	11.56	−11.90
1885	57.9	+3.3	10.89	56.7	+1.3	1.69	+ 4.29
1886	55.8	+1.2	1.44	51.3	−4.1	16.81	− 4.92
1887	54.2	−0.4	0.16	50.4	−5.0	25.00	+ 2.00
1888	51.5	−3.1	9.61	58.0	+2.6	6.76	− 8.06
1889	54.8	+0.2	0.04	55.2	−0.2	0.04	− 0.04
1890	51.0	−3.6	12.96	63.4	+8.0	64.00	−28.80
1891	54.6	0.0	0.00	54.2	−1.2	1.44	0.00
1892	55.1	+0.5	0.25	53.0	−2.4	5.76	− 1.20
1893	57.4	+2.8	7.84	49.2	−6.2	38.44	−17.36
1894	49.5	−5.1	26.01	58.6	+3.2	10.24	−16.32
1895	53.2	−1.4	1.96	56.1	+0.7	0.49	− 0.98
1896	55.5	+0.9	0.81	53.5	−1.9	3.61	− 1.71
1897	55.8	+1.2	1.44	52.1	−3.3	10.89	− 3.96
1898	50.8	−3.8	14.44	59.2	+3.8	14.44	−14.44
1899	55.5	+0.9	0.81	55.2	−0.2	0.04	− 0.18
1900	57.8	+3.2	10.24	52.7	−2.7	7.29	− 8.64
1901	56.2	+1.6	2.56	54.2	−1.2	1.44	− 1.92
1902	56.4	+1.8	3.24	52.2	−3.2	10.24	− 5.76
1903	56.8	+2.2	4.84	52.8	−2.6	6.76	− 5.72
1904	55.7	+1.1	1.21	50.3	−5.1	26.01	− 5.61
1905	58.1	+3.5	12.25	49.8	−5.6	31.36	−19.60
1906	54.6	0.0	0.00	56.0	+0.6	0.36	0.00
1907	52.8	−1.8	3.24	61.1	+5.7	32.49	−10.26
1908	56.9	+2.3	5.29	54.6	−0.8	0.64	− 1.84
1909	54.2	−0.4	0.16	59.2	+3.8	14.44	− 1.52
1910	52.2	−2.4	5.76	53.0	−2.4	5.76	+ 5.76
1911	56.2	+1.6	2.56	58.2	+2.8	7.84	+ 4.48
1912	57.0	+2.4	5.76	52.6	−2.8	7.84	− 6.72
1913	50.6	−4.0	16.00	63.6	+8.2	67.24	−32.80
1914	56.3	+1.7	2.89	55.2	−0.2	0.04	− 0.34
1915	55.2	+0.6	.....	.....	.....	.....	.....
Sums	.....	.....	204.05	.....	.....	553.16	−237.39
Mean	54.6	.....	.....	55.4	.....	.....	.....

$$r = \frac{\Sigma xy}{\sqrt{(\Sigma x^2)(\Sigma y^2)}} = \frac{-237.39}{\sqrt{204.05 \times 553.16}} = -0.707 \pm E_r$$

In the same manner, and using the same 36-year series, correlation coefficients were calculated for various other cities throughout the United States, comparing them in each case with San Diego. These values are entered on the chart, figure 3, and the lines of equal correlation drawn.

The temperature values used were taken, for the most part, from printed copies of local annual meteorological summaries. In a few of these the mean temperatures were recorded to whole degrees only, and there is thus some lack of uniformity, since for the greater number of stations used the temperatures and departures are recorded to tenths. It is to be noted, however, that any accidental errors or lack of homogeneity in the records will numerically lower the values of the coefficients rather than raise them. The means were computed to tenths of degrees only, but to whole degrees only where the original values were in whole degrees. This introduces a slight error, due to the fact that the mean is not expressed with complete accuracy. No correction was made for this error in the values of the coefficients as entered on figure 3, but corrections made in a few cases indicate that the error is not greater than 1 in the third decimal place, and hence is not significant.

Examining the chart, we find a line of zero correlation extending from Minnesota southwestward through Nebraska and Kansas to western Texas. Values are positive and increasing westward from this line to a maximum of 1.00 at the base of comparison, San Diego; but are negative and increase numerically, eastward, to a maximum of over 0.7 in northern Florida. All values of the correlation coefficient numerically greater than 0.5 are more than six times their probable errors, and hence there is less than one chance in 20,000 that the results are accidental. As the smaller values approach zero, there is an increasing probability that the results are due to chance but this is rendered less likely, in the present case, by the consistency of the results at the different stations, enabling fairly symmetrical lines to be drawn in close conformity with all the data. (Two exceptions are to be noted; the results at Boise and Miami, the latter a short record, are not consistent with adjacent values.)

This map seems, therefore, to establish definitely the existence of a well-marked interrelation of temperature changes between southern California and the region comprising the East Gulf and South Atlantic States, and extending also into the Ohio Valley, but best developed in northern Florida.

Los Angeles and other cities.—It will be observed that the area of evident negative correlation is greater than that of well-defined positive correspondence with San Diego. The +0.5 line includes only Nevada, western Arizona, and that portion of California south of San Francisco. The relation of Los Angeles to San Diego is not quite as close as might be expected, while San Francisco is surprisingly divergent. Knowing that a certain January was warmer than the average at San Diego, we can assume that it was also warmer at Winnemucca and Salt Lake City with greater probability than we can make the same assumption for San Francisco. With still greater probability we can assume that it was a cold January in all the Southern States east of the Mississippi River. In order to test still further the reliability of these results, and especially their independence of the San Diego record, Los Angeles departures were used as the basis for the computation of correlation coefficients with several of the southern cities. The values are given in the accompanying Table 2, together with those for December and February. It thus appears that the relation holds about equally well for Los Angeles and for San Diego; and though more clearly exhibited in January, exists in February also.

TABLE 2.—*Coefficients of correlation of certain mean monthly temperatures at Los Angeles with stations in southeastern United States, 1880 to 1915, inclusive.*

Months.	Atlanta, Ga.	Galveston, Tex.	Jacksonville, Fla.	Key West, Fla.	Little Rock, Ark.	New Orleans La.	Norfolk, Va.	Pensacola, Fla.	Tampa, Fla.
	r.	r.	r.	r.	r.	r.	r.	r.	r.
December	+0.085	.....	−0.386	.....	.....	.....	.....	−0.245	−0.335
January	−0.570	−0.417	−0.707	−0.658	−0.345	−0.592	−0.427	−0.654	−0.631
February	−0.450	.....	−0.566	.....	.....	.....	.....	−0.576	−0.488

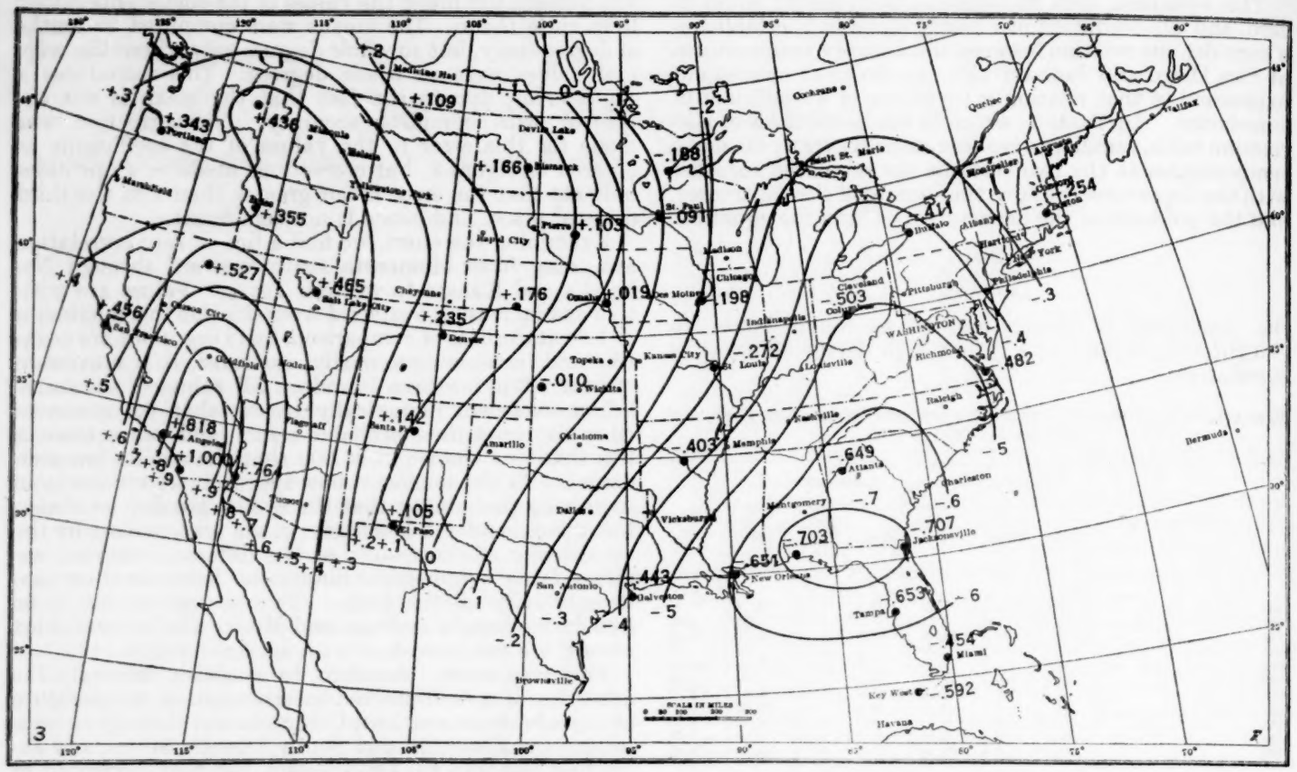


FIG. 3.—Isocorrelational chart of the United States for January mean temperatures (1880-1914). San Diego = 1.000.

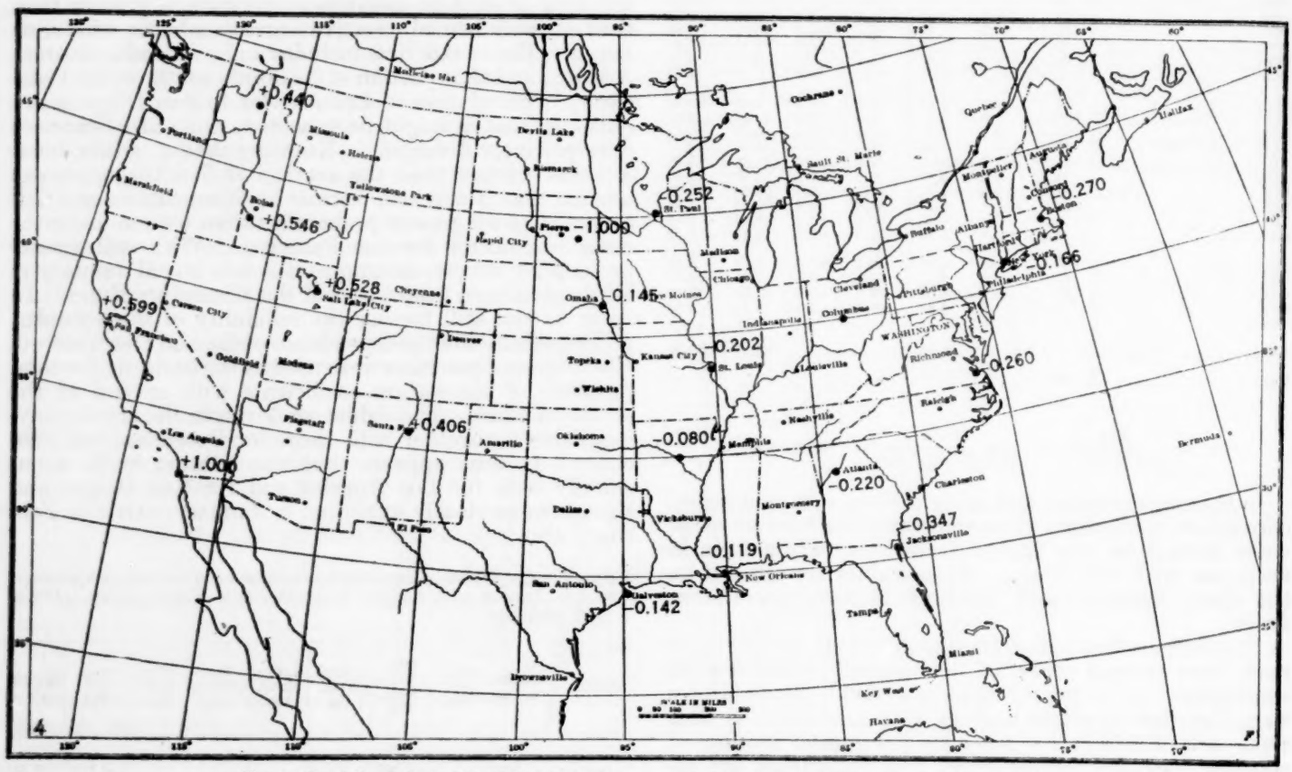


FIG. 4.—Correlational chart of the United States for mean annual temperatures (1880-1915). San Diego = 1.000.

Mean annual temperature relations.

Having shown in some detail the character of the correspondence in January, it is necessary to extend the inquiry to other months and to the year in order to determine the nature of the relationship—whether permanent or periodic. For this purpose, I have correlated the mean annual temperatures of San Diego and various other points in the United States in the same manner and for the same period as was done for January, with the results shown in the chart, figure 4. It will be noted that the country is divided between positive and negative correlation for the mean annual temperatures in about the same manner as for January; that the positive coefficients are in every case larger; but the negative ones are generally smaller. Moreover, the negative coefficients are not so consistently distributed geographically with reference to magnitude, and in no case does a coefficient attain the standard of safety, i. e., six times its probable error. The probable error for Jacksonville is ± 0.099, and for Columbus, ± 0.096. However, the results taken together leave little doubt of some inverse relationship.

Arctowski [2] has discussed the distribution of temperature changes in detail for the period 1900 to 1909, using annual means made up of the means of every 12 consecutive months, thus making a series of 109 values for the 10 years. Using the same period and the same method of "successive means," I have found the following annual correlations with San Diego:

Jacksonville, Fla	-0.371 ± 0.054
Columbus, Ohio	-0.459 ± 0.051
Omaha, Nebr	-0.204 ± 0.060
Salt Lake City, Utah	$+0.437 \pm 0.052$

These, while of about the same magnitude as those shown in figure 4, are, on account of the greater number of values used, well beyond the probability of chance results and confirm the conclusion that there is a permanent annual connection, which, however, is not so close as the January relationship.

Monthly temperature relations.

Let us now go a step farther and examine more closely the nature of this relation. Table 3 and figure 5 give the coefficients of correlation between San Diego and the four eastern stations Atlanta, Boston, Columbus, and Jacksonville, for each month separately.

TABLE 3.—*Coefficients of correlation of mean monthly temperatures at San Diego, with stations in eastern United States, for period 1880 to 1915, inclusive.*

Month.	Atlanta, Ga.	Boston, Mass.	Columbus, Ohio.	Jacksonville, Fla.	Mean.
	r	r	r	r	r
January	−0.649	−0.254	−0.503	−0.704	−0.528
February	− .450	− .270	− .428	− .484	− .408
March	− .324	− .215	− .281	− .514	− .338
April	−0.121	+0.008	−0.246	−0.129	−0.122
May	− .301	− .218	− .056	− .146	− .180
June	− .003	− .187	+ .035	+ .280	+ .031
July	−0.005	−0.252	−0.284	+0.056	−0.121
August	− .353	+ .051	− .411	− .126	− .210
September	− .082	− .177	− .148	− .134	− .135
October	−0.483	−0.197	−0.437	−0.349	−0.366
November	+ .010	+ .058	+ .085	− .058	+ .024
December	+ .085	− .135	+ .065	− .141	− .032
Year	−0.220	−0.270	−0.376	−0.347	−0.303

[2] *Arctowski, Henryk.* Study of the changes in the distribution of temperature in Europe and North America during the years 1900 to 1909. Annals, New York acad. sci., 27 June, 1914, 24: 39-113.

The lower curve of figure 5 represents the average values of the coefficients at the four stations, by months. An examination of these results will lead to the conclusion that

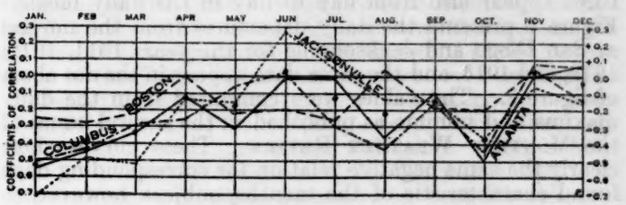


FIG. 5.—Correlations of mean monthly temperatures at San Diego, Cal., (1880-1915) with those of stations in the eastern United States for the same period.
—— Atlanta, Ga. — — — — Boston, Mass.
- - - - Jacksonville, Fla. —.—.—. Columbus, Ohio.
* * * * Mean of the four.

the annual correlation just proven is not, after all, a permanent relation persisting through the year, but is the result of a large correlation in some months, combined with no relation, or even a positive one in other months. It was probably to be expected that the summer months would show a less marked connection; certainly we do find the coefficients small from April to September, inclusive, with a slight positive coefficient for the average of the June results. But the most interesting part of the curves is in October, November, and December. There is a marked increase in the negative coefficient in October followed by a marked decrease to practically zero in November and December. We are safe in stating that there is no linear relation between the monthly temperatures of San Diego and these eastern stations in November and December; but there is a distinct negative relation in October and also in January and February. There is evidence throughout the year of this wave-like alternation in the values of the coefficients, but the period of the waves seems to vary at different seasons of the year, and probably does not in any case coincide exactly with the calendar months.

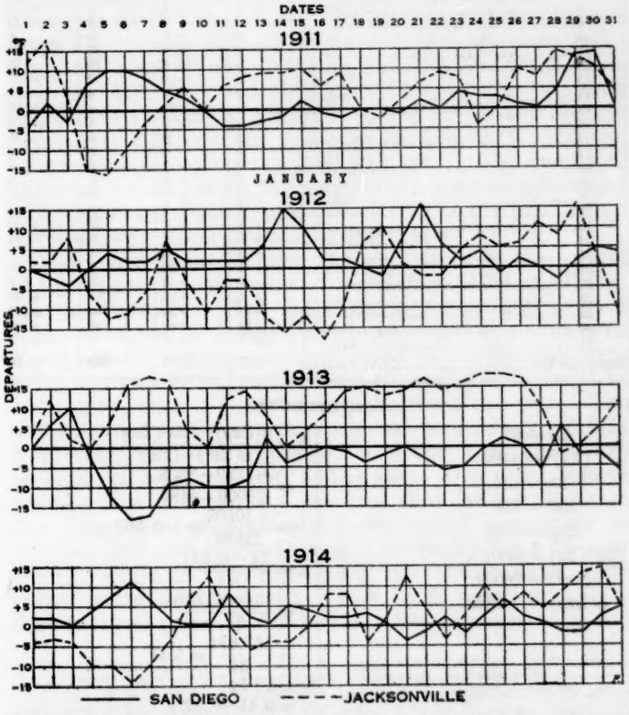


FIG. 6.—Departures of the daily mean temperatures in January at San Diego, Cal., and at Jacksonville, Fla., from the respective normals, during the years 1911-1914, inclusive.

There is still another relationship which naturally suggests itself in this connection. Does the negative correlation which exists in the January mean temperatures appear also from day to day in the daily means? Figure 6 presents the daily departures from the normal at San Diego and Jacksonville for the years 1911, 1912, 1913, and 1914, and the same data appear in the dot chart of figure 7. The values were computed from the daily maxima and minima as published in the several issues of the MONTHLY WEATHER REVIEW. These curves show clearly the same negative relation for corresponding days found characteristic of the months, subject, however, to more frequent exceptions. In Table 4, the daily departures for 1911 are tabulated, and the method of calculating the "line of best fit" is there indicated.[3]

Similar computations were made for 1912, 1913, and 1914, and the four equations derived are as follows:

For 1911, $y=5.41-0.502x$
1912, $y=1.31-0.867x$
1913, $y=8.66-0.331x$
1914, $y=4.34-1.37x$

The corresponding lines are shown in figure 7. Combining the four years into one, we get the equation,

$$y=4.32-0.815x$$

and the line AB, figure 7.

TABLE 4.—*Departures in January, 1911, of the daily mean temperatures from the normal at San Diego, Cal., and Jacksonville, Fla.*

Date.	Departures. San Diego, x	Departures. Jacksonville, y	x^2	xy
1911.	°F.	°F.		
Jan. 1	− 4	+12	16	− 48
2	+ 2	+18	4	+ 36
3	− 3	+ 4	9	− 12
4	+ 6	−15	36	− 90
5	+10	−16	100	−160
6	+10	− 9	100	− 90
7	+ 8	− 3	64	− 24
8	+ 5	+ 1	25	+ 5
9	+ 3	+ 6	9	+ 18
10	0	0	0	0
11	− 4	+ 6	16	− 24
12	− 4	+ 8	16	− 32
13	− 3	+ 9	9	− 27
14	− 2	+ 9	4	− 18
15	+ 2	+10	4	+ 20
16	− 1	+ 6	1	− 6
17	− 2	+ 9	4	− 18
18	0	0	0	0
19	0	− 2	0	0
20	− 1	+ 2	1	− 2
21	+ 2	+ 7	4	+ 14
22	0	+ 9	0	0
23	+ 4	+ 8	16	+ 32
24	+ 3	− 4	9	− 12
25	+ 3	0	9	0
26	+ 1	+10	1	+ 10
27	0	+ 8	0	0
28	+ 4	+14	16	+ 56
29	+13	+13	169	+169
30	+14	+10	196	+140
31	+ 1	+ 4	1	+ 4
Sums (n=31)	+67	+134	839	− 59

COMPUTATIONS.

$\Sigma x=67.$
$(\Sigma x)^2=4489.$
$\Sigma y=134.$
$\Sigma x^2=839.$
$\Sigma xy=-59.$
$(\Sigma x)(\Sigma y)=8978.$
$n(\Sigma x^2)=26009.$
$n(\Sigma xy)=-1829.$

$$b=\frac{n(\Sigma xy)-(\Sigma x)(\Sigma xy)}{n(\Sigma x^2)-(\Sigma x)^2}=\frac{-1829-8978}{26009-4489}=\frac{-10807}{21520}=-0.502$$

$$a=\frac{\Sigma y-b(\Sigma x)}{n}=\frac{134+33.634}{31}=\frac{167.634}{31}=5.41$$

$$y=a+bx=5.41-0.502x$$

[3] For a fuller exposition of the method see "Elementary Notes on Least Squares, etc.," by *C. F. Marvin*. MONTHLY WEATHER REVIEW, October 1916, 44:551-559.

This result was obtained by comparing corresponding days at the two stations, but there is evidence in figure 6 of a lag of one day at Jacksonville. Accordingly, figure 8 was constructed, comparing departures at San Diego with those of Jacksonville on the following day, for the same four years. The resulting figure is very similar, and the resulting equation almost identical, viz,

$$y=4.35-0.829x.$$

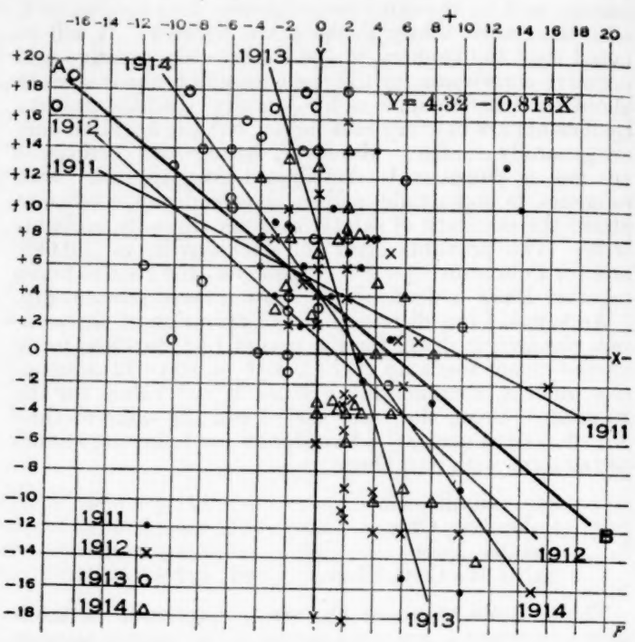


FIG. 7.—Dot chart of departures from the normal, of the daily mean temperatures at San Diego (abscissae) and at Jacksonville (ordinates). Lines of best fit are shown for each year and for the four years combined (A–B).
Line A–B has the equation: $y=4.32-0.815x$.

It will be noted that the lines AB in figures 7 and 8 do not appear to be placed properly for best fit. This frequently happens in constructing such charts, and illustrates the unreliability of the eye in such matters. It is probable that the eye fails to give proper weight to the more distant and scattered dots.

In these two equations and the accompanying figures, the departures were obtained by using the daily normals given in Weather Bureau Bulletin **R**, instead of the means of the period under discussion. These latter are 55° for San Diego and 57° for Jacksonville, greater in each case than the normals given in Bulletin **R**. Hence there is a preponderance of positive departures at both stations in figures 7 and 8, and the line of best fit is at some distance from the origin along the positive segments of both axes. This use of the normals better represents the meteorological conditions, but is not adapted to the computation of standard deviations or correlation coefficients. Using the actual means of the 124 days' record, we obtain the equation,

$$y=0.267-0.828x,$$

when departures for the same days are compared; and

$$y=0.274-0.816x,$$

when departures at San Diego are compared with those of the following day at Jacksonville. The result of this is merely to move the lines nearer the origin, keeping them practically parallel with themselves. That is, the lines represented by this calculation, but not drawn, have

nearly the same slopes as those in figures 7 and 8, respectively. The coefficients of x in these equations express the slopes of the lines, and the slight differences, amounting in the second case to a difference in slope of 0.6°, are due to the fact that at Jacksonville the daily normals are not the same for the whole month, but vary from 53° to 55°. The correlation coefficients in these two cases are −0.507 and −0.500, respectively, which are more than ten times their probable errors. By actually counting and comparing the individual departures for the periods under discussion, we may express the relationships in percentages, as follows: (1) The departures of the January mean at San Diego and Jacksonville are of opposite sign 86 per cent of the time. (2) The daily departures during January, comparing the same days, are either zero or of opposite sign 77 per cent of the time. (3) The daily departures, allowing a lag of one day at Jacksonville, are either zero or of opposite sign 74 per cent of the time. A

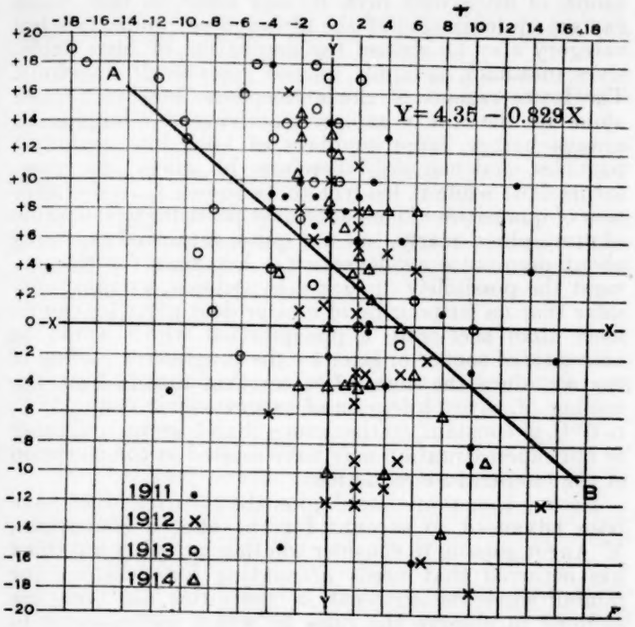


FIG. 8.—Dot chart of departures of the daily mean temperatures at San Diego, Cal. (abscissae) with those for the following day at Jacksonville, Fla. (ordinates), for the years 1911, 1912, 1913, 1914; and the line of best fit for the whole four years (A–B). Line A–B has the equation: $y=4.35-0.829x$.

fairly accurate forecast of the temperature at Jacksonville for any particular day could be made from the temperature at San Diego on the preceding day. We may conclude, I think, that the causes which produce opposite temperature changes at San Diego and Jacksonville, shown in the monthly and even in the annual means, affect the two stations almost simultaneously, being probably a little later, but less than 24 hours later, at Jacksonville.

The intention of this paper being merely to present the facts of these correlations, rather than give adequate explanations of them, no attempt has been made to correlate temperature changes with variations in pressure or solar radiation. However, a brief examination of the January and February isobaric charts, as published in the MONTHLY WEATHER REVIEW, indicates that the interior winter HIGH of the western United States is the connecting link between the temperatures of these widely separated areas. When the center of the HIGH is far westward, over Utah and Nevada, southern California is cold with northerly winds from the interior, and, at the same time, this westward shifting of the HIGH leaves the middle Mississippi Valley with relatively low pressure, inducing onshore warm winds on the South Atlantic and Gulf coasts. A shifting of the high pressure area eastward to the eastern slope of the Rocky Mountains produces cold continental winds in the southern States, and permits the movement of LOWS down the Pacific coast, causing warm southerly and westerly winds in southern California. This in brief is what seems to be indicated by the pressure charts. In this connection it will be remembered that Humphreys[5] has shown that the winter temperatures of the eastern United States are intimately connected with the presence or absence of a western Atlantic high area in the vicinity of the Bermudas. When this disappears or shifts far to the eastward, the eastern United States is cold on account of continental winds. This eastward movement appears to be accompanied by a similar movement in the "Rocky Mountain HIGH," thus contributing to the same cause, especially in the southeastern United States, the northern portion of the country being influenced by barometric changes that pass to the north of the high belt. Conversely, Humphreys also shows that the eastern coast is warm in winter when there is a well-developed HIGH in the western Atlantic; the present study discloses the same condition when the "Rocky Mountain HIGH" moves westward, thus again indicating a synchronous movement of these crests in the belt of high pressure. The permanent "Pacific HIGH," west of southern California, should also be studied in this connection if data were available. Such shiftings of pressure seem to be the immediate cause of the temperature relationships here discussed. * * *

Arctowski, in the study above cited, finds that there are persistent areas of positive and negative temperature departures whose movements are correlated, and that in North America these displacements seem to be confined to the continent, so that in consequence they pendulate from one side to the other. He says that these changes occur "seemingly in correlation with the equatorial temperature changes" and that a center exists in New Mexico, Arizona, and southern California "where the variation displays a striking preference to belong to the inverse type, and that, on the contrary, in Pennsylvania and Oregon the direct type is predominant." The results of the correlations herein discussed are in general agreement with these conclusions, and by arriving at the results in a different way furnish confirmation thereof.

There remains, however, the oscillation in the values of the monthly coefficients of correlation to be explained. Clayton[6] observes that the changes are analogous to a series of waves, and that there is an indication that even for the same station the coefficient of correlation with solar change will be positive for a time, and then negative for a time, with a sharp change between the two. The monthly correlations here presented completely confirm this view, with the important addition that the sharp reversals in relation occur at the same time in successive years. This is shown by the fact that temperatures at San Diego and Jacksonville have varied oppositely in October and also in January and February for a 36-year period, while in November and December they have varied quite independently. It is to be noted especially that these changes in relation are not changes with the

[5] *W. J. Humphreys*, Why some winters are warm and others cold in the eastern United States. MONTHLY WEATHER REVIEW, December, 1914, 42:672–675.

[6] *Clayton, H. Helm.* Effects of short-period variations in solar radiation on the earth's atmosphere; *in* Smithsonian misc. coll., May, 1917. v. 68, no. 3.

advancing seasons, but seem to be true oscillations whose corresponding phases occur at the same time each year. A complete explanation of this phenomenon will doubtless await a long and detailed analysis of the complex changes in the distribution of temperature and pressure over the globe resulting from seasonal changes and from changes in solar radiation.

RAINFALL AND GUNFIRE.[1]

By ALFRED ANGOT, Director,
Bureau Central Météorologique de France.

[*Review reprinted from* Nature, London, Aug. 9, 1917, 99:467-8.]

M. Angot, the eminent director of the French Meteorological Service, has made a valuable and authoritative contribution, published in the journal of the French Academy of Agriculture for May, to the literature of a well-worn controversy.[1] The alleged connection between rainfall and gunfire, in favor of which so many champions sprang up during the wet periods of 1914–1916, has recently lost favor as a subject for argument, owing, no doubt, to the coincidence of the Spring drought of 1917 with the Allied offensive on the western front; but so short is the public memory, especially for negative evidence, that the incidence of 3 inches of rain during a recent summer afternoon in London, N. W., has proved sufficient to disinter the bone of contention [below p. 453]. The mental attitude of the public toward a theory of this nature is of great psychological interest: there is little doubt that, should we experience this summer [1917] a repetition of the weather of July, 1888, when snow fell in London, followed by a recurrence of that of August, 1911, when the thermometer touched 100°F. at Greenwich, both phenomena would generally be attributed to the war.

Accordingly M. Angot's paper reaches us at an opportune moment. After dealing briefly with the historical aspect of the question, and alluding to the work of M. Le Maout—who, not content with having established a connection between the bombardments of the Crimean War and the rainfall of India, the United States, Nicaragua, and Barbados, went on to ascribe the diurnal variation of the barometer to the striking of public clocks and the ringing of church bells—M. Angot proceeds to consider the physical changes which could be effected by the discharge of artillery, and could at the same time be held responsible for the causation, increase, or acceleration of rainfall.

The first proposition is that a succession of violent explosions might result in the displacement of masses of cold air at certain heights, which, coming under the influence of the upper winds and encountering layers of warmer, saturated air, could give rise to precipitation which would not otherwise have occurred: in this connection the author points out that in order to obtain a rainfall of so small an order as 1 mm. (0.04 in.), even if one were to take two equal masses of saturated air, the one at a temperature of 0° C., the other at 20° C. (an extreme case, of course), it would be necessary to effect a rapid and thorough intermingling of the two throughout a layer of air 6,850 meters in thickness. In M. Angot's opinion, the mixing of layers of air may be the cause of cloud formation or of slight drizzle at the earth's surface, but can never be responsible for considerable precipitation.

In the case of the second proposition—that water vapor resulting from chemical reaction of the explosives might take effect—it is asserted that in order to produce the same amount of rainfall (1 mm.) as in the previous proposition, the employment of no fewer than 21,750 tons of melinite per square mile would be necessitated—that, indeed, only on the supposition that all the hydrogen in the explosive became water vapor, which condensed immediately in its entirety and, so to speak, on the spot.

In the third and last instance, the possibility of electrical action being brought into play is considered in some detail. We know that supersaturated air (i. e., air which contains more water vapor than it normally should be able to hold for the existing temperature) is a physical possibility, in the absence of dust particles or other matter which may form nuclei for condensation. The necessary medium may be supplied by the action of ozone, of ultraviolet rays, by any cause, in fact, which can set up ionization of the atmosphere; under this last category may be classed the detonation of high explosives, inasmuch as highly ionized gases result therefrom. The lower regions of the atmosphere, however, which alone are the seat of explosive activity on a large scale, always harbor large numbers of both ions and dust particles, and can not, therefore, be subject to supersaturation; while it has yet to be shown that the addition of quantities of ions or of dust particles to a stratum of atmosphere nearly, but not quite, saturated can bring about premature condensation. Assuming for the moment the possibility of such a hypothesis, we must consider that no outpouring of ions or dust particles can do more than accelerate a precipitation which would be necessitated sooner or later by the progressive cooling of the air, since the mass of water that results from the cooling of, say, a kilogram of saturated air from 15° C. to 0° C. is constant (rather more than 5 grams), whether or not supersaturation may have existed at the inception of the temperature reduction.

Having thus pronounced upon the theories which have been advanced to account for the alleged connection, M. Angot goes on to consider whether in reality anything has occurred that needs accounting for—whether the rainfall since the outbreak of hostilities has been less inclined to observe the rules by which we endeavor to forecast its occurrence than before. Careful comparison between the daily weather maps and the observed rainfall figures has convinced him that it is not. He points out, very rightly, that we have been passing through a series of wet years since 1909—a period that balances the run of dry years 1898–1904 (1903 and 1911 were both exceptions to their groups and may be said to balance each other)—and that excess of rain in 1915 and 1916 might reasonably have been expected; that 1909 was wetter (in France) than 1915; 1910 than 1916; furthermore, that during December, 1915, an unprecedentedly wet month, relative calm prevailed over the whole front, and that in the second 10-day period of the very wet February of 1916, considerably more rain fell (40 mm. as against 28 mm.) than in the last 10-day period, which witnessed the development of the giant German bid for Verdun. Similar conclusions will be reached if frequency of rain instead of amount be considered: 1910 had more rain-days than 1916; 1912 and 1913 both had more than 1915, when the number in France was 11 below the average. The author has found nothing exceptional in the local distribution of rainfall: proximity to the firing zone has not resulted in relatively greater

[1] *Angot, Alfred.* Le canon et la pluie. Comptes rendus, Acad. d'agric. (France), No. 18, 1917, 3: 501-508.

totals or frequencies, while the great Spring offensive of 1917 failed to interrupt the long spell of brilliant weather which accompanied it.

An examination was made some months ago at the British Meteorological Office into the local distribution of rainfall over England during the first 22 months of the war, the results of which afford corroborative evidence for M. Angot's last-mentioned point. It was found that the greatest excess of rain over the normal figure was one of 59 per cent on the south Yorkshire coast; that three areas in Lincolnshire and on the Norfolk and Suffolk coasts, respectively, had rather more than 40 per cent excess; but that round the North Foreland there was a slight deficit. No trace whatever of a distribution having reference to a center over northern France was discoverable.

M. Angot concludes with the reflection that it may be with rainfall and gunfire as it is with weather changes and the phases of the moon, that—

sous la suggestion d'une croyance instinctive on est conduit involontairement à ne remarquer que les coïncidences favorables et à s'affermir ainsi de plus en plus dans cette croyance.

[under the suggestion of an instinctive belief, one is involuntarily led to note only the favorable coincidences and thus become more and more confirmed in the belief.]

For those, indeed, who are cognizant of the relationship between the weather and modern warfare it is not difficult to see the possibility of the connection, but it is a connection in which the amount of gun fire varies inversely as the amount of rain that is falling rather than one which makes the rainfall in any way dependent on the gunfire.—*E. L. Hawke.*

BIRD MIGRATION IN CENTRAL SWITZERLAND IN RELATION TO METEOROLOGICAL CONDITIONS.[1]

By Dr. K. BRETSCHER.

[*Reprinted from* Nature, London, Sept. 20, 1917, 100:47—48.]

The relation of bird migration to meteorological conditions has been considered, of late years, an important part of the study of the movements of birds, and various theories have been advanced to explain their interrelations. In the memoir before us Dr. Bretscher deals very fully with the arrival in Spring and departure in Autumn of the summer visitors to central Switzerland. In relation to these he treats of bird migration and atmospheric pressure, wind, atmospheric precipitation, temperature, etc., and under each heading he has tables of statistics in support of the statements in the text. By Tables 1 and 15 he shows that the position of barometric depressions within the area has, as we should expect, no influence on the arrival of the summer migrants and their departure in autumn. In Tables 3 and 4 he discusses the influence of direction and strength of the wind, and concludes that, in central Switzerland, migration proceeds irrespective of the direction of the wind and that, unless the force be so great as to be a hindrance, the influence of this, too, may be regarded as a negligible quantity. The fourth section deals with atmospheric precipitation in relation to bird migration; as the author tells us in Switzerland even keen ornithologists stay at home in wet weather, we are not surprised to find that they have few direct records of migration in rain, snow, or fog, and he himself says, further observations on this subject are wanted.

What strikes one as being the most interesting of any of the sections are those on spring and autumn migration in relation to temperature. Dr. Bretscher gives many interesting tables showing the number of observations on the movements of each species under each degree of temperature centigrade. These indicate the maximum and minimum between which migration takes place, the gradual increase to the most favorable migration temperature, and the decrease after this is reached. Here we see that birds migrate between certain temperatures, which vary according to the species; thus, the blackbird and song thrush perform their migrations at a lower temperature than the insect-eating warblers. Another aspect is presented in Table 9—namely, the duration of the migration period in relation to the average temperature—and the author here comes to the conclusion that the two are not correlated; thus the warmest average temperature does not necessarily coincide with the shortest migration period, nor does a cold spell mean a lengthening of the time over which the migration extends. Table 10 shows the difference of temperature of the migration day and that directly preceding it, and purports to prove that it is the temperature of the moment, not that which went before, which incites birds to migrate. It seems, however, as if the author had somewhat confused the issue; it can not be the temperature at the point of arrival which incites the birds to begin its migration in Spring. After this we have the various migration dates compared for Switzerland, Hungary, Bavaria, and Württemberg, though as the last has only three entries we think it might have been omitted.

In conclusion, the author indicates his conviction, which is probably shared by most ornithologists, that the real incentive to migration is not to be found in outward circumstances, but must be sought in physiological conditions. The outward conditions, including food, do undoubtedly have some effect on it, but do not produce the necessary impulse. Though there is perhaps nothing startlingly new in this pamphlet, yet it is a welcome addition to the literature relating to migration; it shows much careful work, and the fact that Dr. Bretscher refrains from drawing more than very tentative conclusions adds to, rather than detracts from, its value. He realizes that it is not possible to come to any definite solution of the problem he is studying without observations—and we would add, meteorological data—made over a much wider field.—*W. E. C.*

Weather Bureau men may recall an interesting illustrated article on bird migrations across North and South America, published in the National Geographic Magazine, April, 1911, by W. W. Cooke. One of Mr. Cooke's maps of dates of arrival in the United States is very strongly suggestive of a map of isotherms for the region. In a note accompanying a report of the effect of a severe storm in 1899 on bird movements, Professor Abbe [2] also pointed out that bird movements were chiefly controlled by food supply; but food supply is controlled by the weather and the climate and no doubt some of our experts in correlation investigations will be able to show a close correlation between bird movements and some one of our weather factors. Perhaps such a study has already been made.—C. A., jr.

[1] "Der Vogelzug im schweizerischen Mittelland in seinem Zusammenhang mit den Witterungsverhältnissen." Von Dr. K. Bretscher. Nouveaux mémoires de la Société Helvétique des Sciences naturelles, vol. 51, mem. 2.

[2] *See* MONTHLY WEATHER REVIEW, February, 1899, 27:60.

SOME NUCLEI OF CLOUDY CONDENSATION.

By Dr. J. AITKEN.

(Presented to the Royal Society, Mar. 19, 1917.)

[*Abstract reprinted from* Nature, London, May 17, 1917, 99:239.]

By means of an improved apparatus for producing a series of definite expansions of a given volume of saturated air, the author studied the cloud-producing qualities of dust particles of different sizes obtained in various ways. After the air was cleared of the largest particles by one or more applications of a 2 per cent expansion, cloud-producing particles of smaller sizes were removed in succession by expansions 4 per cent, 6 per cent, 8 per cent, and so on up to 20 per cent, if necessary. The particles were produced by such means as flames, electric sparks, chemical action, and heating of solid substances; and the general conclusion was that in no expansion lower than 25 per cent was there any evidence of electric ions being by themselves efficient nuclei for cloudy condensation. The view that the nuclei of cloudy condensation produced by heat are ions discharged at high temperatures is not supported, since such nuclei are produced at much lower temperatures than that at which ionic discharge from heated bodies occurs; and even at this higher temperature spectroscopic examination shows that some chemical or disintegrating action takes place along with the discharge of the ions.

CONDENSATION AND EVAPORATION OF GAS MOLECULES.

By I. LANGMUIR.

[*Reprinted from* Science Abstracts, Sect. A, July 30, 1917, § 651.]

Previous work by the author gave evidence that atoms of tungsten, molybdenum, or platinum vapors, striking a clean, dry glass surface in high vacuum, are condensed as solids at the first collision with the surface. Similar evidence was obtained from a study of chemical reactions in gases at low pressures. It was concluded that in general, when gas molecules strike a surface, the majority of them do not rebound from the surface by elastic collisions, but are held by cohesive forces until they evaporate from the surface. In this way a theory of adsorption was developed which has been thoroughly confirmed by later experiments, viz, the amount of material adsorbed depends on a kinetic equilibrium between the rate of condensation and the rate of evaporation from the surface. Practically every molecule striking the surface condenses (independently of the temperature), while the rate of evaporation depends on the temperature and is proportional to the fraction of the surface covered by the adsorbed material. R. W. Wood's experiments on mercury atoms impinging on a glass plate at definite temperatures are referred to and discussed, following which comes a review of Wood's experiments on a stream of cadmium atoms, which stream on striking walls of a well-exhausted glass bulb does not form a visible deposit unless the glass is at a temperature below about −90°C., but when started the deposit continues to grow in thickness even after it is warmed to room temperature. Wood concludes that nearly all atoms of cadmium are reflected from surfaces other than cadmium if the initial temperature is above −90°C. The present author criticizes this reflection theory and proposes as a better alternative the condensation-evaporation theory, and, to determine definitely which of the two theories correspond best with the facts, he has repeated Wood's experiments under modified conditions which are described at some length. The experiments prove that single cadmium atoms actually evaporate off of a glass surface at temperatures below room temperature, although they do not do so at an appreciable rate from a cadmium surface. The condensation-evaporation theory thus verified affords a very satisfactory explanation of Moser's breath-figures on glass and the peculiar effect observed in the formation of frost crystals on window-panes. The author opines his theory to be capable of extension to the whole subject of nucleus formations, including the crystallization of subcooled liquids.—*H. H. Ho[dgson.]*

[1] Proceed., Nat'l Acad. Sci., March, 1917, 3:141-147.

COMPUTATION AND MEASUREMENT OF THE COMPLEX MOLECULES OF SOME VAPORS, ACCORDING TO THE NEW CONDENSATION THEORY.[1]

By L. ANDRÉN.

[*Reprinted from* Science Abstracts, Sect. A, Aug. 30, 1917, § 795.]

* * * The series of experiments were conducted in the absence of any electric field; with electric field up to 330 volts/cm; by increasing the never-absent radio-active radiations of the atmosphere and earth with the aid of pitchblende and of weak and strong radium preparations, first with water vapor and air. The experiments with CO_2 as gas gave much the same results. When the gas was hydrogen the results differed from those previously obtained when the small [spherical expansion chamber] was used, but agreed again when the large sphere [260 cu. cm.] was applied; Wilson's condensation chamber, it is pointed out, was still smaller than the author's small [60 cu. cm.] sphere. Alcohol was tried mixed with air and with hydrogen; benzene only in air mixtures. The general conclusion drawn is that the ordinary condensation by expansion depends mainly on the formation of electrically neutral complex vapor molecules and their size and surface tension, and is hence independent of the gas containing the vapors, while the electric carriers (ions) play only a secondary part. The formation of nonelectric nuclei is a function of the vapor; the presence of traces of foreign vapors has no influence, provided chemical reactions (due to radiations) be excluded; the nuclei consist hence of complex polymerized vapor molecules. In addition to these nonelectric nuclei there are electric carriers of both polarities, due to the radiations (terrestrial and atmospheric); they make up perhaps 1 per cent of the whole nuclei and consist predominantly also of vapor molecules. In size the nuclei differ with the nature of the liquid (vapor); but there is no discontinuity between the mists and the drops of a vapor, and the two types of condensation can not be differentiated by definite expansion values. The electric carriers are always the largest nuclei; their number naturally depends also on the gas; their number, 900 (no external field), would correspond to the 0.4 carriers per second per cu. cm. assumed to account for the very small residual conductivity of the air. There are, further, when the supersaturation degree is 5 or more, some very large nonelectric nuclei (0.1 per cent of total number) due to the chemical reactions caused by the terrestrial radiations (H_2O_2, O_3, etc.). By far the greater number of nonelectric nuclei are, however, small in size and consist of complexes of only a few (2 or 3) molecules; their number, deter-

[1] Ann. d. Physik, Feb. 5, 1917, 521:1-71.

mined for each vapor at ordinary temperature, is: water 1.9×10^{-11}, ethyl alcohol 2.5×10^{-11}, benzene 0.8×10^{-11} per cent of the total vapor molecules present, which would correspond to about 100,000,340,000,190,000 molecules per cu. cm. These nonelectric molecules are characteristic for each vapor. Exposure of the vapor-gas mixtures to β and γ radiations, further increases the size of the nuclei, and thus the numbers of molecules per nucleus, to 8 for water and 6 for alcohol; and increases also in particular their number very much, in accordance with the radiation intensity. Lenard's theory supplements Kelvin's theory by adding a term depending on the ratio of the portion of the drop surface from which evaporation can take place, and on the surface tension which varies with the radius and the thickness of the liquid shell. It also differs from J. J. Thomson's theory in so far as with increasing expansion a supersaturation is said to be reached at which all the nuclei are condensed; the total number of nuclei in water vapor (no external field) seems to be limited to 10^5, as stated.—*H. B[orns]*.

A NEW EVAPORATION FORMULA.[1]

By R. E. HORTON.

[*Reprinted from* Science Abstracts, Sect. A, Aug. 30, 1917, § 791.]

In 1802 Dalton deduced the formula $E = C(V - v)$, where E is the rate of evaporation from a liquid surface, V the vapor pressure corresponding with the temperature of the liquid, v the vapor pressure existing in the atmosphere at the time and C is a constant. The effect of the wind was allowed for by varying the value of C. Later workers have usually introduced a factor of the form $(1+kw)$ to allow for the wind speed w. According to the formula thus modified, the rate of evaporation increases indefinitely with increase of wind, whereas in practice a maximum value is obtained when the wind velocity reaches 15 to 20 miles an hour, and above this there is no further increase. The author, therefore, prefers to allow for wind by the introduction of an exponential factor, and deduces the equation,

$$E = C[(2 - e^{-kw})V - v].$$

Values of the coefficient $(2-e^{-kw})$ may be read off from a graph thus simplifying the working. The formula is also applicable to the case of condensation. It will be seen that under certain conditions of temperature and humidity condensation will take place in still air, while there will be slight evaporation under the same conditions in a wind. This result has been verified in practice. The formula as stated applies to a small liquid surface. The latter part of the paper is devoted to a consideration of the case of a larger area where the evaporation from the leeward part will be hindered by the presence of the vapor given off by the part more to windward. The author states that it will, in many cases, be more accurate to calculate the rate of evaporation from a large water surface by means of the formulæ here put forward, than to rely on attempts at direct measurement with the ordinary type of evaporimeter.—*J. S. Di[nes]*.

FORESTS-AND-RAINFALL EXPERIMENTS.

There appeared in Nature, for August 2, 1917 (pp. 445–446), a review by Mr. Hugh R. Mill, of the recent Indian Forest Bulletin No. 33 by M. Hill, chief commissioner of forests of the Central Provinces. Dr. Gilbert Walker of the Indian Meteorological Department contributed two appendices to that bulletin, and concerning Dr. Walker's conclusions Mr. Mill says in part:

> Dr. Walker considers that, as Blanford pointed out in 1887, "the only satisfactory evidence would be that obtained by comparing the rainfall of a district when well supplied with forests with that of the same district when the trees were very few." In our opinion the comparison should not be that of a district A at the time t with the same district at the time t'; but to compare the relation of district A to a contiguous district B at the time t with the relation of A to B at time t', where A is a district that has undergone a great change as regards forest covering, while B has remained unchanged. The reason for this indirect comparison is, of course, to eliminate the effect of the two periods falling in what Prof. H. H. Turner calls different climatic chapters. Another method would be to determine the relation of the isohyetal lines to the configuration of the land on wooded and treeless districts of similar character. As pointed out in the report on the rainfall in the Geological Survey's "Water Supply Memoirs of Hampshire," the district of the New Forest shows a considerably higher general rainfall than its elevation above sea level appears to suggest. The subject is both fascinating and important, and the time will no doubt come when increase of accurate observations will enable the vague belief in the beneficial influence of forests on climate to be supported or corrected by definite meteorological evidence.

It seems appropriate here to recall the circumstance that precisely the first method here suggested by Mr. Mill for solving the problem of the relations between rainfall and forestation was adopted by the United States Weather Bureau in 1910, cooperating with the United States Forest Service. These two services have selected two contiguous and practically indentical watersheds in the Rio Grande National Forest (lat. 37° 45′ N., long. 106° 50′ W., alt. 9,400–11,000 feet) near Wagon Wheel Gap station on the Denver & Rio Grande Railroad, at present under identical forested conditions, and have established therein a large number of thermometer, precipitation, and stream-gage stations. Careful observations will be carried on in both watersheds for a number of years [1] and at the conclusion of this first period one of the watersheds will be deforested and the same observations continued for a second period corresponding to the first one.

Already we have secured nearly a full 6-years' record there, as observations actually began October 22, 1910. While the United States seems to have been the first to take this step, it is certainly desirable that as many other countries as possible should make the same test.

Concerning the second method suggested by Mr. Mill, it is not likely that any area in the United States is sufficiently supplied with well-distributed raingages to encourage one in undertaking the computational labor involved.—C. A., jr.

EXCESSIVE PRECIPITATION IN LONDON, ENGLAND.

[*Reprinted from* Nature, London, June 21, 1917, 99:328.]

Dr. H. R. Mill records, in the London Times of June 19, 1917, that the thunderstorm between 5 and 7 p. m. (summer time) [2] on Saturday, June 16, was, if measured by rainfall, one of the most severe ever experienced in London. More than 2 inches fell over an area measuring 10 miles from Barnes to Finsbury Park and 4 miles from Hyde Park to Willesden Green. At two points within this area more than 3 inches was reported—viz,

[1] Engineering News-Record, New York, Apr. 26, 1917, 78:196-199.

[1] The experiment is described in detail in the MONTHLY WEATHER REVIEW, September, 1910, 38:1453-1455, with map.

[2] "Summer Time." This is the first reference in the MONTHLY WEATHER REVIEW to the "daylight saving" scheme that has been in such general use among European countries since 1916. "Summer time" in England is 1 hour faster than Greenwich Mean Time. A presentation of the advantages and disadvantages of "Summer Time", as developed by a year of actual experience therewith, will be found in Review of Reviews, New York, June, 1916, pp. 715–716.—C. A., jr.

3.20 inches at Campden Hill, Kensington, and 3.37 inches at Barrow Hill, north of Regent's Park. Such falls in a short period have only been exceeded in the London area, so far as Dr. Mill has been able to ascertain, by 3.42 inches at Blackheath on July 23, 1903, and by 3.90 inches at Hampstead on April 10, 1878. On June 23, 1878, Mr. Symons recorded at Camden Square a fall of 3.28 inches in about an hour and a half; on Saturday last the recording gage showed that 2.86 inches fell in 2 hours, and no heavier rain has been recorded at Camden Square in the 39 intervening years.

GREATEST 24-HOUR RAINFALL AT WASHINGTON, D. C.

It is interesting to compare with these very exceptional falls under London's conditions, the following equally exceptional falls under Washington conditions, compiled by Mr. Herbert Lyman from the records of the Washington office of the Weather Bureau.

Greatest rainfalls for any 24 hours at Washington, D. C.

Inches.	Date.	Remarks.
5.80	1878, July 29–30.	
5.66	1874, Sept. 15–16.	
5.00	1904, Sept. 14–15.	
4.96	1898, Aug. 12.	
4.22	1905, July 5–6.	**3.26** inches fell in 1^h 13^m.
4.16	1886, June 22.	
4.12	1876, July 30.	
3.98	1877, Oct. 4.	
3.92	1905, Aug. 25.	
3.67	1910, Oct. 19–20.	Not a thunderstorm fall.
3.50	1886, May 7–8.	
3.48	1900, June 2.	3.04 inches fell in 1^h 8^m.
3.34	1886, July 26–27.	
3.27	1917, July 25.	1.90 inches fell in 1^h.

To this table must be added the remark that in 1906 2.46 inches fell within 56 minutes on August 24.—C. A., jr.

REVOLVING FLUID IN THE ATMOSPHERE.[1]

By Sir NAPIER SHAW.

[*Abstract* of an address before the Royal Society, June 21, 1917.]

It is generally assumed, as appears prticularly from a recent paper by Lord Rayleigh,[2] with reference to a former paper by Dr. J. Aitken, that the motion of air in cyclones and anticyclones may be classed as the motion of revolving fluid, symmetrical about a vertical axis. Reasons are given to show that this assumption with regard to cyclones and anticyclones of middle latitudes is erroneous; that circular isobars on the map do not indicate revolving fluid, and, vice versa, that traveling revolving fluid would not be indicated by a system of circular isobars. The next point for consideration is how a mass of revolving fluid traveling with a speed of translation of the same order as the speed of rotation, and of sufficient size, would be represented on a map. Diagrams are drawn showing the distribution of velocity in four cases for different ratios of the velocity of translation to the velocity of rotation, and assuming that systems of velocities could be fitted to pressure lines of the same shape, it is inferred that cases of traveling revolving fluid would be indicated by isobars similar to those which are classed meteorologically as belonging to small secondaries, or distortions of the isobars, generally on the southern side of the great cyclonic systems. Conditions are next considered which must exist if a column of rotating fluid is maintained and transported within a current represented by the isobars of a great cyclonic depression. The conditions arrived at are briefly: (1) That the velocity of translation must be the velocity corresponding with the separation of the isobars of the main depression unaffected by the presence of the revolving mass. (2) The column must probably extend throughout the troposphere, otherwise it could not be "capped." (3) The velocity of the current transporting the revolving fluid must be the same at all heights. This condition is shown to be satisfied if the line of lapse of temperature with height in the atmosphere corresponds with an adiabatic line, and this is known to be approximately the case in a cyclonic depression where convection has been ubiquitous and vigorous.

[1] *Reprinted from* Nature, London, July 5, 1917, 99:378.
[2] Abstract published in this REVIEW August, 1917, pp. 413–414.—C. A., jr.

MOTION OF A PARTICLE ON THE SURFACE OF A SMOOTH ROTATING GLOBE.[1]

By F. J. W. WHIPPLE.

[*Reprinted from* Science Abstracts, Sect. A, Aug. 30, 1917, § 721.]

The free motion of a particle over a smooth rotating globe has not in the past received much attention, but the author considers that a knowledge of the motion of such a particle will prove a useful preliminary to a proper understanding of the more complicated motion which actually occurs in winds, where the air particles have other forces besides that of gravity acting upon them. After briefly dealing with the case of a particle on a smooth rotating sphere, the case of a globe having a "level" surface is considered. During the motion over the surface the relative speed remains constant. If the velocity is small so that variation in latitude is negligible the track is a circle and the period of the motion relative to the surface of the globe $\frac{1}{2}$ cosec ϕ days (where ϕ = latitude.)

Where variations of latitude must be taken into account the general equations are worked out, but before a complete solution can be found it is necessary to assume that ϕ is small throughout the motion. The equations are thus approximate only and must not be used for high latitudes. The solution then falls into 3 classes according as constant C is positive, zero, or negative. The value of C is governed by the initial motion and starting point of the particle.

The results are illustrated by curves which show the motion of a particle given the velocity of 10 m./sec. over a globe having the dimensions of the earth. The first set of curves (C positive) give oscillatory paths backward and forward across the equator. In the second set ($C=0$) after a looped path the particle approaches the equator asymptotically. In the third case (C negative) motion is confined to one side of the equator. An approximately circular path is followed out, but with a gradual drift to the westward.—*J. S. Di[nes]*.

MOTION OF THE AIR IN THE LOWEST LAYERS OF THE ATMOSPHERE.[2]

By G. HELLMANN.

[*Reprinted from* Science Abstracts, Sect. A, Aug. 30, 1917, § 732.]

From measurements of the wind velocity at five different heights up to 258 meters above the ground at the

[1] Philosophical Mag., London, June, 1917, 33:457–471.
[2] Berichte, Preuss. Akad. Wiss., Berlin, 1917, 10:174–197.

German wireless telegraph station at Nauen, the law is deduced that wind velocities at different heights vary as the fifth-roots of the heights. At 512 meters the velocity is twice that at 16 meters. The diurnal variation of wind velocity at the surface with a maximum in the afternoon extends in winter only to a height of about 60 meters above the ground. Above that height the opposite type of variation is found, with a maximum in the night. The neutral zone between the two types is considerably higher in the Summer, probably at about 300 meters.—*R. C[orless.]*

THE RELATION BETWEEN PRESSURE-GRADIENT, WIND, AND FRICTION IN STEADY MOTION.[1]

By F. ÅKERBLOM.

[*Reprinted from* Science Abstracts, Sect. A, Aug. 30, 1917, §731.]

On the assumption that motion of the air near the earth's surface could be treated like the steady motion of a particle, Guldberg and Mohn developed simple equations connecting wind velocity with horizontal pressure gradient, latitude, air density, and friction. In forming the equations it was assumed that friction acted in a direction opposed to that of the surface wind. Comparison with observations, however, showed that the equations were inapplicable to surface winds in the interior of continents, that coastal winds conformed more nearly with them, while observations at a single station at sea gave satisfactory agreement with them.

The author introduced the conception of friction acting in a direction different from that of the surface wind reversed, on the ground that the upper wind, which affects the surface wind by friction as well as the ground, usually differs in direction from that wind. Comparison with observations in Europe, America, and over the North Atlantic gives values of the angle between the direction of friction and the reversed direction of the surface wind which vary from 30° to 60° and are slightly greater over sea than over land. Over land the angle appears to show a maximum in the early afternoon and a minimum at night.—*R. C[orless.]*

THE FORMATION OF ANTICYCLONIC STRATUS.[2]

By C. K. M. DOUGLAS.

[*Reprinted from* Science Abstracts, Sect. A, Aug. 30, 1917, §727.]

The clouds here termed stratus, which include those of the stratus-cumulus type, are found, by observation from an aeroplane, to have an adiabatic temperature gradient below them and a reversed gradient above them. Within the cloud the gradient is usually adiabatic, and there is considerable turbulence. On the north and east sides of anticyclones there is nearly always a layer of stratus or of haze with cloud patches. The height of the layer varies between 3,000 and 6,000 feet. It is pointed out that stratus may be formed by the adiabatic compression of nonhomogeneous cloudy air, the layers of cloud where there is initially most free water present becoming less warmed than the layers above and below after the water has evaporated from these, and so giving rise to the reversed gradient above the remaining layer of cloud. A reversed gradient may also be formed at any layer above which there is a pronounced increase of westerly wind, this westerly current being normally warm and tending to raise the temperature at its level. By the use of a formula put forward by Napier Shaw it is demonstrated that this is particularly likely to happen on the northern sides of anticyclones at any height where there is initially a smaller vertical temperature gradient than normal, the tendency being for this abnormality to become accentuated.—*J. S. D[ines.]*

[1] Ark. för Mat., astron., och fysik, Stockholm, 1916, 11, No. 18. 19 p.
[2] Proc., Roy. Soc., Edinburgh, 1916-17, 37:137-148.

WINDWARD ISLANDS VS. LEEWARD ISLANDS.

The Washington office of the United States Weather Bureau recently received a query from our observer at Basseterre, St. Christopher, British West Indies, concerning the exact scope of the terms Windward Islands and Leeward Islands when used in the cabled storm warnings of this bureau. As the Weather Bureau is now

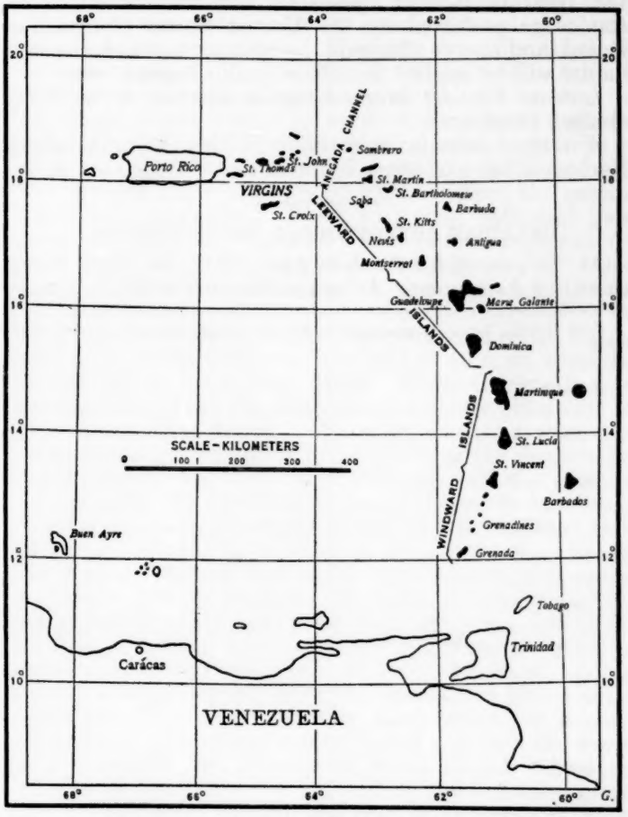


FIGURE 1.—Sketch map outlining the Windward and the Leeward Islands as now defined.

engaged in extending its network among the islands of the West Indies, and probably will soon begin to make numerous references to the islands, this question is one of considerable immediate interest. In view of the somewhat confusing usage in existing atlases it seemed desirable to submit the question to the United States Geographic Board for a statement as to the preferred usage, the following was received in reply:

UNITED STATES GEOGRAPHIC BOARD,
Washington, D. C., Oct. 16, 1917.

Prof. CHARLES F. MARVIN,
Chief of Weather Bureau.

DEAR SIR: In reply to your inquiry of 9th inst., I have to say that considerable confusion has existed as to the application of the names "Windward Islands" and "Leeward Islands." Originally the name

"Lesser Antilles" was applied to the whole chain of islands from Porto Rico to Trinidad, the latter island sometimes being included, and by some geographers excluded.

Later the Lesser Antilles were divided into two groups, the Leeward Islands extending from Porto Rico to and including Dominica Island, and the Windward Islands taking in the remainder of the chain.

The later usage has been to exclude Virgin Islands and Danish West Indies and apply the name Leeward Islands to the group from Anegada Channel to and including Dominica Island, and the name Windward Islands to the remainder of the chain, including Barbados, but excluding Trinidad and Tobago.

This later usage seems to have been generally adopted by the best authorities.

Yours, respectfully, ANDREW BRAID, *Chairman.*

The West Indies are shown in some detail on Charts VIII and IX of the MONTHLY WEATHER REVIEW, June, 1898, and later; also on Chart X of the issue for December, 1916. None of these, however, bring out just the boundaries mentioned. The little sketch map presented by figure 1, therefore, is lettered to bring out what the Weather Bureau forecasters now understand to be the usage preferred by the United States Geographic Board, and also to illustrate the manner in which the two names will be applied hereafter by this bureau, viz:

Leeward Islands: From Anegada Channel to and including Dominica.

Windward Islands: Remainder of the chain, including Barbados, but excluding Trinidad and Tobago.—C. A., jr.

CANADIAN ASTRONOMICAL APPOINTMENTS.[1]

At the time of his death in April, 1916, Dr. W. F. King was Chief Astronomer of Canada, director of the Dominion Observatory at Ottawa, Boundary Commissioner, and director of the Canadian Geodetic Survey. He had developed these positions about himself and it was recognized that no single person could well succeed him in all of them. The work has been adjusted as follows: First, Mr. J. J. McArthur was appointed Boundary Commissioner, then Dr. J. S. Plaskett was made director of the new Dominion Astro-physical Observatory at Victoria, B. C.; third, Mr. Noel J. Ogilvie has been appointed superintendent of the Geodetic Survey; and just now (October, 1917) Dr. Otto [Julius] Klotz has been appointed Chief Astronomer and director of the Dominion Observatory. Dr. Klotz is a native of Preston, Ontario, (b. 1852); entered the service of the Dominion Government in 1879; was associated with Dr. King in the founding of the observatory; has been Assistant Chief Astronomer there since 1908, and acting director since April, 1916.

While joining the editor of the Journal in his good wishes for all these appointees, it is with particular pleasure that we here record the fact that Dr. Klotz was urged for his new position in a wholly voluntary petition signed by all the other members of the force at the Dominion Observatory. Dr. Klotz has always shown much interest in the meteorology, climatology, and seismology of North America and of the United States, and it may reasonably be expected that in the future various contributions from him will appear in these pages, in addition to the regular monthly seismological reports now being published.—C. A., jr.

[1] *From* Journal, Royal Astronomical Society of Canada, Toronto, October, 1917, 11:358.

SECTION III.—FORECASTS.

FORECASTS AND WARNINGS FOR SEPTEMBER, 1917.

By H. C. FRANKENFIELD, Supervising Forecaster.

[Dated: Weather Bureau, Washington, D. C., October 1, 1917.]

GENERAL PRESSURE DISTRIBUTION OVER THE NORTHERN HEMISPHERE EXCEPT EUROPE AND INTERIOR ASIA.

High pressure prevailed uniformly throughout the month over the Pacific Ocean, although only slightly above the normal over the southeastern portion. Over the Aleutian Islands alternations of moderately high and low pressure prevailed until after the 16th, when low pressure predominated, with a marked depression on the 21st and a more sustained one of somewhat less intensity from the 24th to the 27th, inclusive.

Over Alaska high pressure ruled during the first 8 or 10 days of the month, and low pressure thereafter, the principal depression occurring on the 22d, one day after its appearance at Dutch Harbor in the Aleutian Islands.

Over the United States the month was one of moderately high pressure as a rule until the last few days of the month, except in the Gulf and South Atlantic States, where below normal conditions prevailed during the second half of the month, with a tropical storm from the Caribbean Sea that reached the Middle Gulf coast on Sept. 29, when a barometer reading of 28.51 inches was reported at Pensacola, Fla.

Pressure was also high over the North Atlantic Ocean during much of the month. A storm from that section of the ocean to the eastward of the Lesser Antilles passed near the Island of Bermuda on the 4th, moving in a northeasterly direction (29.46 inches at Hamilton), but no further data have been obtained at this writing.

Other Caribbean Sea and Atlantic disturbances are discussed in another portion of this report.

WASHINGTON DISTRICT.

On the morning of September 5 a well-defined disturbance was central a short distance northwest of Lake Superior, and southwest storm warnings were accordingly ordered on Lake Erie and the Upper Lakes, except western Lake Superior, where northwest warnings were ordered. At 3 p. m. the warnings were extended over Lake Ontario. The disturbance moved almost due eastward attended by some moderately strong southwest winds over the Northern Lakes, but over the southern and eastern sections only moderate to fresh winds occurred.

On the 6th there were indications of a disturbance near the Windward Islands. Unsettled conditions continued during the 6th and 7th, after which the disturbance disappeared. The usual advisory messages were distributed on both days, but no warnings were issued.

On the morning of the 8th a moderate disturbance from the west was central over Virginia, with high pressure to the northeastward, indicating increasing northeast winds, and at 11 a. m. northeast warnings were ordered displayed on the Atlantic coast from Sandy Hook, N. J., to Boston, Mass. Only moderately strong winds occurred during the afternoon, and at 9 p. m., with the disturbance dissipating over North Carolina, the warnings were lowered.

On the morning of the 10th there were some slight evidences of the formation of a disturbance over the west Caribbean Sea and of another at about latitude 14°N., longitude 64°W. Special observations were requested and the usual advices issued. The situation was kept under careful observation during the ensuing four days of moderately low pressure, but no storm of consequence developed, although on the morning of the 13th there was a moderate but clearly defined circulation over southeastern Cuba. However by this time the barometer was falling rapidly along the South Atlantic coast with increasing northeast winds, and at 2 p. m. northeast storm warnings were ordered from Jacksonville, Fla., to Fort Monroe, Va., it being apparent at that time that there was a disturbance some distance off the Georgia coast, possibly an offshoot from the general Caribbean depression. Fresh to strong northeast gales occurred along the Carolina coast, continuing until the morning of the 17th. Pressure was only slightly below normal, but at the same time it was quite high to the northward and northeastward. On the afternoon of the 14th the northeast warnings were continued from Charleston, S. C., to Fort Monroe, Va., and at 10 p. m. extended northward to Nantucket, Mass. While the winds were strong north of the Virginia capes, no severe gales were reported over that region. Warnings, however, were continued for a second period of 24 hours, as the disturbance persisted near the North Carolina coast. On the morning of the 17th the disturbance began to move northeastward, and northeast storm warnings were ordered from Block Island, R. I., to Boston, Mass. At 8 p. m. the disturbance was off Nantucket Lightship with a strong northeast gale in progress (64 miles an hour), and the northeast warnings were accordingly extended northward to Eastport, Me. The storm center turned more to the eastward during the night of the 17th–18th, and no strong winds occurred along the immediate Maine coast, although they must certainly have prevailed a short distance at sea. On the morning of the 19th the storm center was in the vicinity of Sable Island, where the barometer read 29.14 inches, and by the following morning it had passed beyond the field of observation, going some distance south of Newfoundland, St. Johns reporting a barometer reading of 29.54 inches in the evening of the 19th with light northeast winds.

The tropical storm of September 21–29, 1917.—On the morning of September 21 heavy southeast and south sea swells were reported from the Leeward Islands. Special observations indicated their continuance, and accordingly at 4 p. m. advices were issued to the effect that there was a disturbance a short distance north of the Virgin Islands moving northwestward. At 10 a. m. on the following day this information was repeated, but delayed reports received sometime later indicated that the disturbance was a short distance south of the Island of Santo Domingo, moving westward or west-northwestward and proper advices were immediately issued. However,

there were still indications that a more moderate disturbance had moved northwestward to the north of the Leeward Islands as indicated by a later fall in pressure in the Atlantic with accompanying northeast gales. During the 22d and the ensuing night the disturbance continued westward, and early in the morning of the 23d it passed with great intensity directly north of the Island of Jamaica, moving in a northwesterly direction. The observer at Kingston reported a barometer reading of 29.14 inches at 4:45 a. m., and press reports stated that great damage had been done over the northern portion of the Island. At noon of the 23d northeast storm warnings were ordered on the South Florida coast from West Palm Beach on the Atlantic side to Boca Grande on the Gulf side, and advices issued urging that every precaution against a dangerous storm should be taken. On the morning of the 24th the storm center was apparently in the vicinity of the Grand Cayman Island, and advices were issued accordingly. At 4 p. m. further advices stated that the storm was apparently nearing the Yucatan Channel or extreme western Cuba and extreme caution was urged for all vessels in the Gulf of Mexico. In the meantime pressure had fallen considerably over the Atlantic Ocean in the vicinity of latitude 30° N. and near the coast, probably the secondary depression noted several days previous north of the Virgin Islands. Over the North Atlantic marked high pressure prevailed, and northeast storm warnings were therefore ordered at 10:30 a. m. from Fort Monroe, Va., to Wilmington, N. C., with forecast of strong northeast winds or moderate gales. After the receipt of special reports in the afternoon northeast warnings were ordered at 7 p. m. on the New England coast from Block Island, R. I., to Provincetown, Mass. In both localities the strong winds occurred as forecast.

The tropical disturbance continued on its northwesterly course, and on the morning of the 26th all vessels in the Gulf of Mexico were again advised to exercise extreme caution. There were, of course, very few radio reports received from the vicinity of the storm, but approximate localities of the center from day to day were as follows: On the morning of the 25th a short distance south of extreme western Cuba, where the barometer at Isle of Pines read 29.42 inches with a northeast wind of 30 miles an hour; on the morning of the 26th near and a little west of latitude 25° N., longitude 85° W., the steamer *Gulfmaid*, then in that vicinity, reporting a strong southeast gale and a heavy sea; on the morning of the 27th about 150 miles south or south-southeast of the mouth of the Mississippi River, the steamer *Abarangez* in latitude 26° 30′, N., longitude 87° W., reporting a barometer reading of 29.56 inches, with a southeast gale of 74 miles an hour; in the evening of the 27th, south of and probably about 75 miles from the mouth of the Mississippi River, the steamer *Abarangez* reporting a barometer reading of 29.62 inches with a southeast hurricane wind blowing 90 miles or more; on the morning of the 28th the storm center was close to the mouth of the river, the steamer *Suriname* anchored at Pilottown, La., reporting a barometer reading of 29.18 inches with a northeast hurricane wind. At 9 a. m. the *Suriname* reported a barometer of 29.06 inches with the wind backed to north and still blowing a hurricane. This was probably very close to the storm center, for by noon the wind at Pilottown, La., where the *Suriname* lay at anchor, shifted to northwest with a barometer reading of 29.24 inches and a wind velocity of 74 miles an hour. Barometer, wind and weather reports from the *Suriname* were as follows:

Hour.	Barometer.	Wind.		Weather.
		Direction.	Velocity.	
Sept. 27, 1917.	*Inches.*		*Miles per hour.*	
8 a. m.	29.80	e.	14	Partly cloudy.
2 p. m.	29.74	e.	18	Rain.
4 p. m.	29.72	e.	18	Do.
8 p. m.	29.66	e.	40	Cloudy.
10 p. m.	29.66	e.	40	Rain.
12 midnight	29.58	e.	56	Do.
Sept. 28.				
2 a. m.	29.50	ne.	90	Do.
4 a. m.	29.36	ne.	90	Do.
8 a. m.	29.18	ne.	90	Do.
9 a. m.	29.06	n.	90	Do.
10 a. m.	29.08	n.	90	Do.
12 noon	29.24	nw.	74	Do.
2 p. m.	29.36	nw.	64	Do.

Barograph traces for New Orleans, Mobile, and Pensacola are on file.

After 4 p. m. of the 28th no telegraphic reports were received from Mobile during the progress of the storm, and none from Pensacola after noon of the same date. A belated message from Mobile received shortly before midnight stated that the lowest barometer reading during the storm was 29.16 inches and the maximum wind velocity 98 miles an hour from the north. The message also stated that there had been no injurious tides (owing to the prevailing northerly winds); that there had been no deaths in Mobile; and that vessels had taken refuge up the river. The damage was limited mainly to roofs and frail structures.

The storm evidently recurved very close to and just east of the mouth of the Mississippi River, moved thence northeastward, passing to the southward of Mobile, and at 7 p. m. passed south of Pensacola, Fla., with a barometer reading of 28.51 inches, a maximum wind velocity for 5 minutes of 103 miles an hour from the southeast, and an extreme velocity of 125 miles an hour from the same direction. The damage was estimated to have been rather less than during the hurricane of October 18, 1916, when the lowest barometer was 28.76 inches and the maximum and extreme velocities 114 and 120 miles an hour, respectively. During the storm of September 28 the tide at Pensacola rose 4½ feet above the normal height.

The following details have been supplied by William F. Reed, jr., meteorologist and official in charge of the Pensacola, Fla., station:

The roar of the hurricane surf could be heard in Pensacola, which is 6 miles from the Gulf coast, by 12 midnight of the 26th, when the center of the storm was some hundred miles distant. The surf on the morning of the 27th increased to "very high" by 10 a. m., but subsided somewhat in the afternoon, when southerly winds by 6 p. m. became light and shifted to east.

On the morning of the 28th (Friday) the future course of the hurricane was uncertain; the surf had been very high all night; easterly winds were increasing and the barometer began falling. Flocks of small seagulls were observed flying inland between 6 a. m. and 7.30 a. m. seeking places of safety at the heads of the bayous. Upon inquiry I found that old residents considered this a sure sign of the immediate approach to our coast of a hurricane, and that these small gulls flew inland in large flocks just previous to the storm of September 26–27, 1906. On Friday morning shipping interests and commanding officers at the navy yard and forts and superintendents of railroads were phoned to take every precaution, since the premonitory signs indicated that the storm was close at hand.

The full force of the storm at Pensacola was felt near 4 p. m. on the afternoon of September 28. The lowest pressure (reduced to sealevel)

was 28.51 inches, at 6 p. m.; the highest wind velocity for a five-minute period was 103 miles from the southeast at 3.48 p. m. The table below shows the barometer readings, wind directions and velocities at short intervals during the 28th. The center of the hurricane evidently passed south of Pensacola, probably a distance of 50 miles.

The damage at Pensacola and vicinity was largely due to wind and wave action. A number of small craft, including the U. S. S. *Quincy*, were washed ashore or grounded and considerable damage was done to wharves, docks, and boat houses along the Gulf shore.

The damage by wind is estimated at	$100,000
The damage by wave action and water at	50,000
The damage to small craft	20,000
Total for Pensacola and vicinity	170,000

Heavy damage appears to have been sustained in Santa Rosa County, where much timber was blown down and crops, live stock, and buildings suffered from wind and rain.

TABLE 1.—*Barometer readings (sealevel) and wind velocities for the five minutes ending with the times given at Pensacola, Fla., Sept. 28, 1917, Weather Bureau office.*

[Wm. F. Reed, jr., and G. S. Kennedy, observers.]

Time.	Barometer.	Wind.		Tide above normal.
		Direction.	Velocity.	
Sept. 28, 1917.	*Inches.*		*Miles per hour*	*Feet.*
7:00 a. m.	29.73	ne.	25	2.0
8:20 a. m.	29.69	e.	35	2.5
10:00 a. m.	29.61	e.	53	3.0
11:00 a. m.	29.56	e.	56	.....
11:30 a. m.	29.50	e.	60	.....
11:45 a. m.	29.46	e.	67	.....
NOON	29.45	e.	72	3.5
12:30 p. m.	29.43	e.	80	.....
1:00 p. m.	29.38	e.	80	.....
1:30 p. m.	29.31	e.	76	.....
2:00 p. m.	29.21	e.	84	.....
2:30 p. m.	29.13	e.	82	.....
2:35 p. m.	.....	e.	96	.....
2:45 p. m.	29.09	se.	90	.....
3:00 p. m.	29.08	se.	84	.....
3:15 p. m.	29.03	se.	90	.....
3:30 p. m.	29.00	se.	94	4.5
3:45 p. m.	28.93	se.	96	.....
4:00 p. m.	28.90	se.	96	.....
4:15 p. m.	28.86	se.	96	.....
4:30 p. m.	28.81	se.	96	.....
4:45 p. m.	28.75	se.	96	.....
5:00 p. m.	28.71	se.	96	.....
5:15 p. m.	28.62	e.	94	.....
5:30 p. m.	28.54	e.	96	.....
5:37 p. m.	.....	e.	100	.....
5:45 p. m.	28.51	e.	96	.....
6:00 p. m.	28.51	e.	92	.....
6:15 p. m.	28.51	ne.	78	.....
6:20 p. m.	.....	ne.	88	.....
6:30 p. m.	28.52	ne.	80	.....
6:45 p. m.	28.56	ne.	84	.....
7:00 p. m.	28.62	n.	78	.....
7:15 p. m.	28.65	n.	92	.....
7:30 p. m.	28.80	nw.	88	.....
7:45 p. m.	28.83	nw.	88	.....
8:00 p. m.	28.90	nw.	80	.....
8:15 p. m.	28.92	nw.	92	.....
8:30 p. m.	28.99	nw.	84	.....
8:45 p. m.	29.04	nw.	84	.....
9:00 p. m.	29.09	nw.	78	.....
9:15 p. m.	29.11	nw.	80	2.5
9:30 p. m.	29.17	nw.	84	.....
9:45 p. m.	29.19	nw.	71	.....
10:00 p. m.	29.22	nw.	76	.....
10:15 p. m.	29.24	nw.	60	.....
10:30 p. m.	29.30	nw.	70	.....

Press reports stated that five lives were lost at Crestview, Fla., an inland town about 40 miles northeast of Pensacola. No other loss of life was reported.

On the morning of the 29th the storm was central over southeastern Alabama with greatly decreased intensity (29.48 inches at Montgomery), but with sufficient rains to necessitate the issue of warnings of a moderate flood over the watershed of the lower Alabama River.

On the evening of the 29th the center was over southwestern Georgia with a still further decrease in intensity (29.64 inches at Thomasville), and by the morning of the 30th the remnants had passed off the Georgia coast, the general low-pressure conditions along the South Atlantic coast having joined forces with another disturbance from the West that was central over Ontario. As pressure was rising rapidly in the rear of the general depression and falling over the North Atlantic Ocean, northwest storm warnings were ordered at noon September 30 from Delaware Breakwater, Del., to Nantucket, Mass. At 10 p. m. the warnings were extended to Eastport, Me. Moderate gales occurred along the New Jersey coast, but none to the eastward and northward, and at 10 a. m. October 1 the warnings were lowered.

The first display of warnings of the approaching storm was made at 5 p. m. September 25, when hurricane warnings were ordered on the Gulf coast from Apalachicola to Mobile, and all Gulf shipping was again warned to take every precaution necessary to insure safety. It was thought at that time that the storm would probably reach the Gulf coast some time during Wednesday night or Thursday morning, but subsequent developments proved that the movement of the storm center was slower than had been anticipated. Half an hour later southeast storm warnings were ordered on the Gulf coast of Florida from Key West to Tampa and northeast warnings from Rockwell to Carrabelle, and moderately strong winds occurred during the night along the south coast. At 5 p. m. of the 26th the hurricane warnings were continued from Apalachicola to Mobile, and at 10 p. m. extended westward to New Orleans, it appearing probable at that time that the storm center might possibly strike the Gulf coast a little farther west than had been first anticipated. At 11 a. m. of the 27th the hurricane warnings from Apalachicola to St. Andrews, Fla., were changed to southeast storm and inland storm warnings were given wide distribution over extreme northwestern Florida, southwestern Alabama, southern Mississippi, and southeastern Louisiana.

The hurricane warnings east of New Orleans were renewed on the morning of the 28th, and southeast storm warnings again ordered at St. Andrews and Apalachicola, it being apparent at the time that the recurving of the storm was in progress, although on the previous evening there had been no such evidence.

At noon, after the wind at Pilottown, La., had changed to northwest with rapidly rising pressure, the forecaster at New Orleans notified shipping at Texas ports that vessels bound for Atlantic and Caribbean ports could proceed with safety.

At 8 p. m. of the 28th, although reports were missing from the vicinity of the storm center, the surrounding pressure distribution indicated a sufficient gradient to warrant the extension of storm warnings (southwest) on the Gulf coast of Florida from Carrabelle to Rockwell, and on the Atlantic coast (southeast and northeast) from Jacksonville, Fla., to Fort Monroe, Va. However, as the decrease in the storm's intensity was very rapid only fresh winds occurred, except in the vicinity of Jacksonville, where a velocity of 44 miles an hour from the southeast was reported on the afternoon of September 29.

The storm passed too far south of Mobile to cause serious damage at that place.

Frost warnings.—From September 5 to 8, inclusive, there were a few light local frosts over widely scattered areas in the extreme north, but on the morning of the 9th a high-pressure area of great magnitude was central over Manitoba, accompanied by temperatures below the freezing point, and frost warnings were accordingly ordered for upper Michigan and northern and central lower Michigan, and on the following morning frost

occurred as forecast. At this time the crest of the high pressure area was over Minnesota, and general frost warnings were ordered for the entire Lakes Region, the central portions of Indiana and Ohio, western and northern Pennsylvania, the interior of eastern New York and northern New Jersey, and the greater portion of New England. Heavy frost was forecast for the Upper Lakes Region, also frost for the cranberry marshes of New Jersey. On the morning of the 11th frosts occurred almost exactly as forecast. The frost was heavy in localities, and there was even a light frost in the District of Columbia, probably the earliest date of frost for many years. At New Lisbon, N. J., in the cranberry bogs, the minimum bog temperature was 23°, while at Hazardville, in the tobacco section of Connecticut, the minimum temperature was 22°. The high-pressure area was decreasing in magnitude, but frost warnings were again ordered for the Middle Atlantic States, the upper Ohio Valley, and the Lakes Region, except upper Michigan. This forecase was also verified, the frost extending into into extreme southern Virginia. By this time the pressure was falling generally, and no further warnings were issued except for the cranberry bogs of New Jersey, which were followed by a bog temperature of 30° on the following morning.

There was no further occasion for frost warnings until the 20th, when a rapid pressure rise following a moderate disturbance over northern Illinois indicated the probability of frost on the following morning over upper Michigan, contingent upon clearing weather. The weather cleared but only light local frosts occurred. Local frosts again occurred in other portions of upper Michigan on the morning of the 22d for which no warnings had been issued. A frost warning issued on the morning of the 22d for the New Jersey cranberry bogs failed on account of increased wind velocity, other conditions being favorable. Warnings for northern New England were fully verified on the morning of the 23d, the frosts also extending into northern and western New York. The warnings were repeated on the 23d for northern New England, and frosts were reported on the following morning. No frosts occurred over the eastern districts from the 24th to the 30th, inclusive, and none was forecast. On the morning of the 30th, with a marked disturbance over Ontario, low pressure throughout the Atlantic States and rapidly rising pressure, with low temperatures over the Plains States, frosts were forecast for the Upper Lakes and western Lower Lakes regions and the upper Ohio Valley. On the morning of October 1 frosts were reported in the upper Lakes Region, Indiana, and western Ohio. There were also light local frosts in Kentucky and Tennessee.

WARNINGS FROM OTHER DISTRICTS.

Chicago forecast district.—The special warnings issued during the month of September were confined for the most part to frost warnings, and especially to the cranberry and tobacco sections of Wisconsin.

General frost warnings for whole States, however, were issued at various times during the month, the more important ones being those of the 9th, 10th, and 21st for the western Lakes Region, and valleys of the upper Mississippi and the Red River of the north, and those of the 27th and 29th for these sections and also the middle and lower Missouri Valley. The warnings, as a rule, were well verified, and the interest in the situation was most intense on account of the possible damage to the corn crop which, as a matter of fact, suffered considerable injury in the more northerly sections.

In the special warnings issued, as well as in the summary published in the corn and wheat region bulletin of the Chicago center, special reference was made not only to the probability of impending frost but also as to moderation later on; in fact during the second half of the month a special long-range forecast was daily included in the summary, covering the situation quite fully and it met with general approval among the grain interests.

The tobacco interests in Wisconsin are of much importance, and the situation there this fall was most unusual, as the entire crop had been purchased as it stood in the field, the buyer taking chances of damage by frost. Moreover, the season was two weeks or more later than usual, so that harvesting was not completed until near the close of the month. The tobacco growers of Wisconsin have practically no means of protection, except to cut their plants, as smudging is not practiced to any extent; and it is often a question as to whether the loss will be greater from cutting immature plants or exposing them to frost. This must depend upon the maturity of the plant on the one hand and the possible damage by frost on the other. A plant only slightly damaged is more satisfactory than one rather immature. Each case, however, must be left to the judgment of the grower, after having been advised as to the probable weather conditions.

The chief damage to the tobacco crop was done on the nights of the 9th and 10th, when more or less heavy frost occurred throughout the region. Advisory messages were sent in advance to the various growers; the message of the 10th stating that the temperature would moderate the following day. The frosts which occurred later were local and not severe and of little consequence as compared with the above.

The conditions in the cranberry marshes were even more critical than in the tobacco region, as previous drought had resulted in a shortage of water for use in flooding the marshes. Warnings of positive frost were issued to the marshes on the 5th, 9th, 10th, 20th, 21st, 27th, 28th, and 30th. The frosts were most severe on the nights of the 9th, 10th, and 30th, in some of the bogs the temperature falling as low as 14° and 15°. The warning messages usually contained advice as to the probability of moderation later on, in order that the growers might conserve their water by allowing it to remain on the bogs until after the second night if frost was again likely. Moreover, other advices were sent to them from time to time.

Special fire-weather forecasts were made during the month for the national forests of Montana, Wyoming, and the Black Hills, the messages including probability of rain, direction and velocity of wind, and change in temperature. The advices to Montana were discontinued on the 14th when general rains closed the fire-weather season in that State. Forecasts were continued to the Black Hills and Wyoming for the balance of the month, as the general rains of the 14th were not sufficiently heavy in these sections to eliminate the fire danger.

Special long-range forecasts were made as follows:

September 15, for the following week for Rapid City, S. Dak. In connection with the forecast, "Prospect seems favorable for fair weather during greater portion of coming week with moderate temperature first half

of period," the observer at Rapid City under date of September 22 reports as follows:

To-night brings to a conclusion a highly successful week for the First Alfalfa Palace Fair at Rapid City, the success of which was made possible by the ideal weather during the week. On one day only was there any precipitation and then only 0.05 inch. I desire to congratulate you on your excellent forecast for the event, and I assure you the action taken in this connection is greatly appreciated by the citizens of Rapid City.

September 10, 11, and 12, for Topeka, Kans., for the following week:

September 10: Somewhat doubtful at present about weather conditions this week and can not make forecast with definiteness to-day.
September 11: Prospects still a little uncertain balance of week, but present indications do not point to much precipitation. Temperature will now rise and continue moderate.
September 12: Present prospect for mostly fair weather and mild temperature balance of week.

Regarding these advices the section director at Topeka under date of September 13 writes as follows:

I wish to thank you for the special messages regarding probable weather conditions for the State fair here this week. They were exactly what we needed, even if somewhat negative in character, and the information contained in them was given a timely circulation in both afternoon and morning papers.—*H. J. Cox, District Forecaster.*

New Orleans forecast district.—The most noteworthy feature of the weather in this district in September, 1917, was the severe tropical storm which caused hurricane winds in southeastern Louisiana, south and east of New Orleans, on the 28th. Ample warnings regarding this hurricane were issued from the central office at Washington. A separate report on the storm and the distribution of the warnings will appear in the October REVIEW.

Small-craft warnings were issued on the 15th for the Louisiana coast and the Texas coast from Port Arthur to Corpus Christi, because of the presence of a disturbance off the Louisiana coast. This disturbance moved northwestward and small-craft warnings were ordered on the 16th on the Texas coast east of Matagorda Bay. The warnings were justified except that velocities were moderate west of Matagorda Bay on the 15th.

Northeast storm warnings were ordered displayed at Burrwood, Morgan City, Empire, and Pilottown, La., at 4.30 p. m. of the 26th, because of the tropical disturbance in the middle eastern Gulf, for the benefit of shipping and fishing interests. These warnings were changed to hurricane warnings at 10 p. m. on advices from the central office and were verified. The apparent extent and continued northwestward movement of the tropical disturbance made it appear advisable to display northeast storm warnings on the Texas coast, and such warnings were ordered from Port Arthur to Corpus Christi on the morning of the 27th. The available data at that time did not furnish good indications of the probable location of the recurve in the path of the disturbance. The recurving of the storm near the mouth of the Mississippi River, on the morning of the 28th, prevented it from being felt to any great degree on the Texas coast. Fresh to strong north winds occurred on the east Texas coast.

Frost warnings were issued on the 26th for the Texas Panhandle and northwestern Oklahoma; light frost occurred in the Panhandle and frost temperatures in northwestern Oklahoma. Warnings of the probable occurrence of frost in central and northeastern Oklahoma and extreme northwestern Arkansas were issued on the 27th, but temperatures the following morning were a little too high for frost under the conditions.

For the benefit of growers who were harvesting rice or other crops, forecasts of fair weather were extended 24 hours beyond the usual period for Arkansas on the 21st, 22d, and 29th, and for Louisiana on the 29th. These forecasts were verified.—*R. A. Dyke, Assistant Forecaster.*

Denver forecast district.—Temperature conditions during September were more favorable than usual—at least during recent years. Frost warnings for high districts were issued on the 14th, 15th, 23d, and 24th, and for lower elevations on the 25th, 26th, 27th and 29th. The damage that resulted from the frosts was small.—*Frederick H. Brandenburg, District Forecaster.*

San Francisco forecast district.—For nearly the entire month of September the pressure was relatively low in the Pacific States. It was relatively high over Alaska until about the 7th, when the barometer fell and relatively low pressure continued in that locality until the 26th, at which time cable trouble occurred and no more reports were received from Nome, Tanana, Eagle, Valdez, Juneau, and Sitka.

The dry spell was broken in the western portion of the North Pacific States on the 8th and in the eastern portion on the 11th. No rain of consequence occurred in California until the 21st, when moderate amounts fell in the northern half of the State. Dry weather still continues in the southern half of California and in portions of Nevada.

Small-craft warnings were issued for Washington seaports and at the mouth of the Columbia River on the 14th and 26th; storm warnings were issued from Eureka to Mendocino on the 21st and from Harford to San Diego on the 29th. The small-craft warning on the 26th was fully verified. That on the 14th was not, as the storm moved eastward farther north than expected, and the highest wind reported was 36 miles per hour from the southeast at North Head, Wash. The storm warnings were verified, but issued too late to be of the fullest value to the public.

Frost warnings were issued on four occasions for Nevada and once for southeastern Idaho. They were all verified. Light frosts formed once in western Nevada and heavy frost formed once in northeastern Washington without warnings.

Special rain warnings were issued on the 21st, 28th, and 29th for the benefit of the fruit industry in California, and they all were verified, the one issued on the 21st being especially timely and beneficial.—*E. A. Beals, District Forecaster.*

SECTION IV.—RIVERS AND FLOODS.

RIVERS AND FLOODS DURING SEPTEMBER, 1917.

By ALFRED J. HENRY, Professor in Charge.

[Dated: Weather Bureau, River and Flood Division, Oct. 31, 1917.]

Fairly heavy rains fell on the upper watersheds of Carolina rivers on August 31 and again on September 1 and 2, causing moderate flood in the tributaries of the Santee of South Carolina on the 2d, 3d, and 4th and a freshet stage in the Cape Fear River of North Carolina at Elizabethton on the 4th. Heavy rains over the Coastal Plain of North Carolina on the 14th and 15th caused overflows in the Tar River only. Heavy rains in Georgia and adjacent States at the close of the month caused a marked rise in the rivers of Georgia and a little damage to corn in the lowlands. Flood stage was reached in the Oconee at Milledgeville, Ga., only.

A considerable flood wave passed down the Rio Grande during the closing days of the month. The following account of it has been furnished by Meteorologist B. Bunnemeyer, in charge of the Texas section of the River and Flood Service:

Large portions of the Rio Grande Valley were flooded successively from Eagle Pass, Tex., to Brownsville, Tex., from September 26 to October 7, when the crest of the flood reached Brownsville. When the flood-warning service of the Rio Grande was reorganized some years ago, residents in the lower valley held that rises from Eagle Pass and Laredo were not dangerous, as they flattened rapidly in their downward course, and that most of the flood waters came from the San Juan, which empties into the Rio Grande from the Mexican side just above Rio Grande City. Be this as it may, in this case most of the water came from Del Rio and Eagle Pass, although no reports of heavy rains reached this office.

Warnings of this flood were sent by the observer at Del Rio to the river observer at Eagle Pass on September 24 and 26, who reported for the two days a total rise of 12 feet near Del Rio. Reports of rises were subsequently received from the river observers at Eagle Pass, Laredo, and Rio Grande and distributed immediately upon receipt. On September 28 all parties were advised that flood conditions were expected in the lower valley, and on September 29 they were requested to warn all interests affected.

The crest of the flood passed Eagle Pass on September 28, with a stage of 23.4 feet; Laredo on September 29, with a stage of 21 feet; and Rio Grande City on October 1, with a stage of 21.7 feet. The Cameron County Water Improvement District No. 2 at San Benito reported that for two days—October 4 and 5—the water at their headgates stood at an elevation of 51.25 feet, based on their datum, the zero of which is about 7.85 feet above sea level, and the observer at Brownsville reported that the crest of the flood reached his city about noon October 7.

The damage from the high water in the Brownsville section is estimated at $100,000, affecting mostly the Gulf coast lines, lumber yards, ice plant, cottonseed oil mill, flour mill, wholesale grocers, many retail dealers, and probably 100 families. About 45 blocks of the city were under water. There was very little damage elsewhere, as nearly all crops had been gathered and stock was driven from the lowlands. Reports from several agricultural sections in the valley indicate that the soaking of the land from the overflow will be decidedly beneficial for the next crop. At Eagle Pass stock valued at $12,000 was saved by the warnings. At San Benito construction work was carried on in several places, and the warnings gave the Water Improvement District No. 2 time to prepare, otherwise they would have suffered serious damage at their headgates.

According to press dispatches the damming of the Arroyo Colorado, which formerly carried much of the flood waters into the Gulf of Mexico, diverted the water to the Brownsville section, although the flooding of the city was directly due to the breaking of a levee on a lake between the city and the river. A large force of United States troops aided in preventing the spread of the overflow.

Hydrographs for typical points on several principal rivers are shown on Chart I. The stations selected for chartering are Keokuk, St. Louis, Memphis, Vicksburg, and New Orleans, on the Mississippi; Cincinnati and Cairo, on the Ohio; Nashville, on the Cumberland; Johnsonville, on the Tennessee; Kansas City, on the Missouri; Little Rock, on the Arkansas; and Shreveport, on the Red.

TABLE 1.—*Flood stages in Atlantic coast drainage during September, 1917.*

River.	Station.	Flood stage.	Above flood stages—dates.		Crest.	
			From—	To—	Stage.	Date.
		Feet.			*Feet.*	
Fishing Creek	Enfield, N. C.	14			13.0	17
Tar	Greenville, N. C.	13	17	22	15.5	19
Do	Tarboro, N. C.	18	18	18	18.0	18
Cape Fear	Elizabethtown, N. C.	22			20.2	4
Peedee	Cheraw, S. C.	27	2	3	30.1	3
Santee	Ferguson, S. C.	12	9	13	12.7	12
Do	Rimini, S. C.	12	4	10	13.5	8
Wateree	Camden, S. C.	24	2	3	27.2	3
Catawba	Catawba, S. C.	11	1	2	14.2	2
Broad	Blairs, S. C.	15			13.6	3
Saluda	Chappells, S. C.	14			13.2	4
Do	Pelzer, S. C.	7	2	3	8.8	2
Oconee	Milledgeville, Ga.	22	30	(*)	24.4	30

* Continued into October.

TABLE 2.—*Flood stages in western Gulf drainage during September, 1917.*

River.	Station.	Flood stage.	Above flood stages—dates.		Crest.	
			From—	To—	Stage.	Date.
		Feet.			*Feet.*	
Nueces	Cotulla, Tex.	15			14.7	7
Rio Grande	Eagle Pass, Tex	16	27	29	23.4	28
Do	Rio Grande City, Tex.	15	28	(*)	20.8	30

* Continued into October.

MEAN LAKE LEVELS DURING SEPTEMBER, 1917.

By UNITED STATES LAKE SURVEY.

[Dated: Detroit, Mich., Oct. 6, 1917.]

The following data are reported in the "Notice to Mariners" of the above date:

Date.	Lakes.*			
	Superior.	Michigan and Huron.	Erie.	Ontario.
Mean level during September, 1917:	*Feet.*	*Feet.*	*Feet.*	*Feet.*
Above mean sealevel at New York	602.73	581.68	573.28	246.93
Above or below—				
Mean stage of August, 1917	+0.04	−0.22	−0.29	−0.42
Mean stage of September, 1916	−1.08	+0.89	+0.99	+0.24
Average stage for September, last 10 years	+0.03	+1.06	+0.94	+0.75
Highest recorded September stage	−1.35	−1.75	−0.66	−0.68
Lowest recorded September stage	+1.24	+2.02	+2.00	+2.93
Average relation of the September level to—				
August level	+0.1	−0.2	−0.3	−0.4
October level	±0.0	+0.2	+0.3	+0.4

* Lake St. Clair's level: In September, 576.25 feet.

SECTION V.—SEISMOLOGY.

SEISMOLOGICAL REPORTS FOR SEPTMBER, 1917.

W. J. HUMPHREYS, Professor in Charge.

[Dated: Weather Bureau, Washington, D. C., Nov. 2, 1917.]

TABLE 1.—*Noninstrumental earthquake reports, September, 1917.*

Day.	Approximate time, Greenwich Civil.	Station.	Approximate latitude.	Approximate longitude.	Intensity Rossi-Forel.	Number of shocks.	Duration.	Sounds.	Remarks.	Observer.
		CALIFORNIA.								
1917.	*H. m.*		° ′	° ′			*M. s.*			
Sept. 4	23 57	Calexico	32 41	115 30	3	1				I. R. Ralston.
8	19 01	Calexico	32 41	115 30	3	2	½	Rumbling		H. M. Rouse.
12	11 26	Berkeley	37 52	122 16	3	1			Recorded on instruments	E. F. Davis.
		Los Gatos	37 12	121 58	2	1	10	None		I. H. Snyder.
		Mountain View	37 23	122 05	3	1	Few			Chas. A. Huff.
		San Jose	37 20	121 54	2	1	5	None		U. S. Weather Bureau
		San Francisco	37 48	122 26	3	1	3	Faint		U. S. Weather Bureau
		Santa Cruz	36 57	122 02	2	1	3	None		W. R. Springer.
13	2 14	Eureka	40 48	124 11	4	2		None	Windows rattled	U. S. Weather Bureau.
24	21 21	Campbell	37 17	121 57	3	1		None		F. M. Righter.
		Hollister	36 50	121 20	4	1	8	do		J. N. Thompson.
		Los Gatos	37 12	121 58	3	1	15	do	Recorded on instrument	I. H. Snyder.
		Salinas	36 36	121 40	3	1	5	do		E. D. Eddy.
		San Francisco	37 48	122 26	3	1	3	do		F. D. Young.
		Santa Cruz	36 57	122 02	4	2	4	do		W. R. Springer.
		Watsonville	36 55	121 46	4	1	Few	Faint		E. H. Haack.
25	18 34	Calexico	32 41	115 30	2	1	½	None		H. M. Rouse.
		MINNESOTA.								
3	21 28	Aldrich	46 23	94 53	5	1	1	Rumbling		Nettie Hansen.
		Alexandria	45 53	95 20	3	1				P. O. Unumb.
		Brainerd	46 21	94 08	5-6	3	7	Rumbling	Bricks fell from chimneys	J. A. Hoffman.
		Crosby	46 30	93 51	4	1	5	do		E. B. Brown.
		Crow Wing	46 17	94 15		1		do		Martin Berggreen.
		Eagle Bend	46 10	95 00	4-5	1	20	do		W. J. Sorff.
		Fort Ripley	46 09	94 17		1		do		C. A. Tucker.
		Henning	46 20	95 23	3-4			Faint	Dishes jarred	Louise von Ohlen.
		Grant	46 37	94 33	5	1	20	Rumbling		E. M. Hinch.
		Gull Lake Dam	46 27	94 16	4-5	1	10	do		A. L. Wampel.
		Jenkins	46 38	94 17	4-5	1			Shook buildings	O. B. Whitney.
		Leader	46 30	94 36	5	1	5	Rumbling	Windows and stoves rattled	O. A. Olsen.
		Lincoln	46 13	94 37	6	1		do	Plaster cracked	H. H. Craighead.
		Long Prairie	45 58	94 50	3	1		None		L. E. Stalicop.
		McGregor	46 37	93 16	3	1	2	Rumbling		Elmer Hallberg.
		Merrifield	46 30	94 06	3	1	6	do		Quin Parker.
		Milaca	45 44	93 38	3				Dishes rattled	Esther Riesland.
		Minneapolis	44 59	93 18	2-3	1	10	None		A. E. Houstario.
		Motley	46 20	94 36	5	1	25	Rumbling		E. G. Haymaker.
		Onamia	46 04	93 38	3			do		Henry Gonlet.
		Parkers Prairie	46 10	95 16	5	1	20	do		Aaron Lundblad.
		Philbrook	46 18	94 40	5	2		do		J. W. Winsot.
		Pierz	45 58	94 02	3	1		do		C. E. Gravel.
		Pillager	46 20	94 24	5	2	20	do		J. C. Peterson.
		Pine River Dam	46 42	94 23						H. F. Leider.
		Pequot	46 37	94 16	4-5	3	6	Rumbling	Goods shaken off shelf	A. R. Holman.
		Sauk Center	45 47	94 57	3	1	6			Dr. A. L. Blix.
		Staples	46 22	94 45	6	1	10	Rumbling	Walls cracked	R. Arundel.
		Sylvan	46 21	94 22	5			do		
		Verndale	46 24	94 59		1		do		Lewis Bradford.
		Wadena	46 27	95 06				do		Postmaster.

TABLE 2.—*Instrumental reports, September, 1917.*

(Time used: Mean Greenwich, midnight to midnight. Nomenclature: International.)

[For significance of symbols see REVIEW for July, 1917, p. 373.]

Date.	Character.	Phase.	Time.	Period T.	Amplitude. A_E	Amplitude. A_N	Distance.	Remarks.

Alaska. *Sitka.* *Magnetic Observatory.* U. S. Coast and Geodetic Survey. J. W. Green.

Lat., 57° 03′ 00″ N.; long., 135° 30′ 06″ W. Elevation, 15.2 meters.

Instruments: Two Bosch-Omori, 10 and 12 kg.

Instrumental constants:

	V	T_0
E	10	16
N	10	15

(No earthquake recorded during September, 1917.)

Arizona. *Tucson.* *Magnetic Observatory.* U. S. Coast and Geodetic Survey. F. P. Ulrich.

Lat., 32° 14′ 48″ N.; long., 110° 50′ 06″ W. Elevation, 769.6 meters.

Instruments: Two Bosch-Omori, 10 and 12 kg.

Instrumental constants:

	V	T_0
E	10	13.9
N	10	18.9

1917.			H. m. s.	Sec.	μ	μ	km.	
Sept. 11	.....	e_E	9 35 45	2	.....	.....	.....	
		e_N	9 35 50	4	.....	.....	.....	
		M_E	9 36 34	5	20	.....	.....	
		M_N	9 36 42	5	.....	30	.....	
		F	9 44 ..	.....	.....	.....	.....	
21	.....	e	8 44 26	2	.....	.....	.....	
		M_E	8 45 04	5	20	.....	.....	
		M_N	8 45 17	5	.....	20	.....	
		F	8 53 ..	.....	.....	.....	.....	
21	.....	e_E	21 23 57	4	.....	.....	.....	
		e_N	21 24 00	3	.....	.....	.....	
		M_N	21 24 50	9	.....	20	.....	
		M_E	21 25 03	8	20	.....	.....	
		F	21 23 ..	.....	.....	.....	.....	

California. *Berkeley.* *University of California.*

Lat., 37° 52′ 16″ N.; long., 122° 15′ 37″ W. Elevation, 85.4 meters.

(See Bulletin of the Seismographic Stations, University of California.)

California. *Mount Hamilton.* *Lick Observatory.*

Lat., 37° 20′ 24″ N.; long., 121° 38′ 34″ W. Elevation, 1,281.7 meters.

(See Bulletin of the Seismographic Stations, University of California.)

California. *Point Loma.* *Raja Yoga Academy.* F. J. Dick.

Lat., 32° 43′ 03″ N.; long., 117° 15′ 10″ W. Elevation, 91.4 meters.

Instrument: Two-component, C. D. West seismoscope.

(No earthquake recorded during August and September, 1917.)

California. *Santa Clara.* *University of Santa Clara.* J. S. Ricard, S. J.

Lat., 37° 26′ 36″ N.; long., 121° 57′ 63″ W. Elevation, 27.43 meters.

(See record of the Seismographic Station, University of Santa Clara.)

Date.	Character.	Phase.	Time.	Period T.	Amplitude. A_E	Amplitude. A_N	Distance.	Remarks.

Colorado. *Denver.* *Sacred Heart College.* Earthquake Station. A. W. Forstall, S. J.

Lat., 39° 40′ 36″ N.; long. 104° 56′ 54″ W. Elevation, 1,655 meters.

Instrument: Wiechert 80 kg., astatic, horizontal pendulum.

1917.	*		H. m. s.	Sec.	μ	μ	km.	
Sept. 10	.....	L_N	8	.....	.....	.....	.....	Distinct sinusoidal waves but very small.
		M_N	8 02 ..	.....	.....	.....	.....	
		F_N	11	.....	.....	.....	.....	
17–18	.....	.....	.....	.....	.....	.....	.....	Small waves and thickening of pen marks at times during day, especially on E-W.
21	.....	L_N	17 50 ..	.....	.....	.....	.....	Very small but distinct waves.
		F_N	17 57 ..	.....	.....	.....	.....	
25–26	.....	.....	.....	.....	.....	.....	.....	Distinct wavelets on both components during day.
26–27	.....	.....	.....	.....	.....	.....	.....	Distinct sinusoidal waves at intervals during day, especially on N-S. Long period, small amplitude.
30	.....	L_N	2 45 ..	.....	.....	.....	.....	Distinct sinusoidal waves at intervals during day, but especially at hours marked. Large period, small amplitude.
		M_N	11 10 ..	.....	.....	.....	.....	
		F_N	13 02 ..	.....	.....	.....	.....	

District of Columbia. *Washington.* *U. S. Weather Bureau.*

Lat., 38° 54′ 12″ N.; long., 77° 03′ 03″ W. Elevation, 21 meters.

Instrument: Marvin (vertical pendulum, undamped. Mechanical registration).

Instrumental constants:

V	T_0
110	6.4

1917.			H. m. s.	Sec.	μ	μ	km.	
Sept. 20	.....	e?	3 46 14	.....	.....	.....	.....	
		eL	3 59 40	.....	.....	.....	.....	
		L	4 02 00	16	.....	.....	.....	
		F	4 15 00	.....	.....	.....	.....	

District of Columbia. *Washington.* *Georgetown University.* F. L. Tondorf, S. J.

Lat., 38° 54′ 25″ N.; long., 77° 04′ 24″ W. Elevation, 42.4 meters. Subsoil: Decayed diorite.

Instruments: Wiechert 200 kg., astatic, horizontal pendulums, 80 kg., vertical.

Instrumental constants:

	V	T_0	ε
E	165	5.4	0
N	143	5.2	0
Z	80	3.0	0

1917.			H. m. s.	Sec.	μ	μ	km.	
Sept. 20	.....	e?	3 46 09	.....	.....	.....	.....	Mainka shows e at $3^h\ 47^m\ 31^s$. Very heavy microseisms present.
		L_N	4 01 00	20	.....	.....	.....	
		L_E	4 02 18	20	.....	.....	.....	
		F	4 40 00	.....	.....	.....	.....	

TABLE 2.—*Instrumental reports, September, 1917*—Continued.

Hawaii. *Honolulu. Magnetic Observatory.* U. S. Coast and Geodetic Survey. Frank Neumann.

Lat., 21° 19′ 12″ N.; long., 158° 03′ 48″ W. Elevation, 15.2 meters.

Instrument: Milne seismograph of the Seismological Committee of the British Association.

	T_0
Instrumental constant..	18.6

Date.	Character.	Phase.	Time.	Period T.	Amplitude. A_E	Amplitude. A_N	Distance.	Remarks.
			H. m. s.	*Sec.*	μ	μ	*km.*	
1917. Sept. 5	.....	eP.....	16 42 36	.....	.....	.....	.....	
		eL.....	16 49 30	.....	.....	.....	.....	
		M.....	16 51 06	18	*100	.....	.....	
		F.....	17 25 ..	.....	.....	.....	.....	
16	.....	eP.....	17 13 54	.....	.....	.....	.....	F lost in air tremors.
		eL.....	17 17 00	.....	.....	.....	.....	
		M.....	17 17 54	18	*200	.....	.....	
		C.....	17 26 ..	.....	.....	.....	.....	
17	.....	eL.....	14 47 00	19	.....	.....	.....	
		M.....	14 51 00	.....	*100	.....	.....	
		F.....	14 55 ..	.....	.....	.....	.....	
18	.....	eL.....	22 08 12	19	.....	.....	.....	
		M.....	22 16 00	.....	*100	.....	.....	
		F.....	22 22 ..	.....	.....	.....	.....	
20	.....	eP.....	2 58 18	.....	.....	.....	.....	
		S.....	3 06 06	.....	.....	.....	.....	
		eL.....	3 17 24	20	.....	.....	.....	
		M.....	3 23 00	18	*1,500	.....	.....	
		C.....	3 29 ..	.....	.....	.....	.....	
		F.....	4 19 ..	.....	.....	.....	.....	
23	.....	eL.....	16 15 30	20	.....	.....	.....	
		M.....	16 22 12	.....	*100	.....	.....	
		F.....	16 29 ..	.....	.....	.....	.....	
24	.....	eP.....	20 17 30	.....	.....	.....	.....	
		eS.....	20 24 54	.....	.....	.....	.....	
		eL.....	20 36 00	23	.....	.....	.....	
		M.....	20 40 48	21	*700	.....	.....	
		C.....	20 42 54	.....	.....	.....	.....	
		F.....	21 14 ..	.....	.....	.....	.....	

* Trace amplitude.

Kansas. *Lawrence. University of Kansas.* Department of Physics and Astronomy. F. E. Kester.

Lat., 38° 57′ 30″ N.; long., 95° 14′ 58″ W. Elevation, 301.1 meters.

Instrument: Wiechert.

		V	T_0	ϵ
Instrumental constants..	E	177	3.4	4.0
	N	205	3.4	3.8

(Report for September, 1917, not received.)

Maryland. *Cheltenham. Magnetic Observatory.* U. S. Coast and Geodetic Survey. George Hartnell.

Lat., 38° 44′ 00″ N.; long., 76° 50′ 30″ W. Elevation, 71.6 meters.

Instruments: Two Bosch-Omori, 10 and 12 kg.

		V	T_0
Instrumental constants...	E	10	32
	N	10	27

(No earthquakes recorded during September, 1917.)

Massachusetts. *Cambridge. Harvard University Seismographic Station.* J. B. Woodworth.

Lat., 42° 22′ 36″ N.; long., 71° 06′ 59″ W. Elevation, 5.4 meters. Foundation: Glacial sand over clay.

Instruments: Two Bosch-Omori 100 kg. horizontal pendulums (mechanical registration).

		V	T_0	ϵ
Instrumental constants..	E	80	23	0
	N	50	25	4.1

(Report for September, 1917, not received.)

Missouri. *Saint Louis. St. Louis University.* Geophysical Observatory. J. B. Goesse, S. J.

Lat., 38° 38′ 15″ N.; long., 90° 13′ 58″ W. Elevation, 160.4 meters. Foundation: 12 feet of tough clay over limestone of Mississippi system, about 300 feet thick.

Instruments: Wiechert, 80 kg. astatic, horizontal pendulum.

	V	T_0	ϵ
Instrumental constants..	80	7	5:1

(Report for September, 1917, not received.)

New York. *Buffalo. Canisius College.* John A. Curtin, S. J.

Lat., 42° 53′ 02″ N.; long., 78° 52′ 40″ W. Elevation, 190.5 meters.

Instrument: Wiechert 80 kg. horizontal.

	V	T_0	ϵ:1
Instrumental constants..	80	7	5:1

(Report for September, 1917, not received.)

New York. *Ithaca. Cornell University.* Heinrich Ries.

Lat., 42° 26′ 58″ N.; long., 76° 29′ 09″ W. Elevation, 242.6 meters.

Instruments: Two Bosch-Omori, 25 kg., horizontal pendulums (mechanical registration).

		V	T_0	ϵ
Instrumental constants..	E	13	22	4:1
	N	14	25	4:1

(Report for September, 1917, not received.)

New York. *Fordham. Fordham University.* W. C. Repetti, S. J.

Lat., 40° 51′ 47″ N.; long., 73° 53′ 08″ W. Elevation, 23.0 meters.

Instrument: Wiechert, 80 kg.

		V	T_0	ϵ
Instrumental constants..	E	72	6.6	1.5:1
	N	72	7.1	3.8:1

(No earthquake recorded during September, 1917.)

Panama Canal Zone. *Balboa Heights.* Isthmian Canal Commission.

Lat., 8° 57′ 39″ N.; long., 79° 33′ 29″ W. Elevation, 27.6 meters.

Instruments: Two Bosch-Omori, 100 kg.

	V	T_0
Instrumental constants..	35	20

Date.	Character.	Phase.	Time.	Period T.	Amplitude. A_E	Amplitude. A_N	Distance.	Remarks.
			H. m. s.	*Sec.*	μ	μ	*km.*	
1917. Sept. 11	.....	P.....	4 11 15	.....	.....	.....	210	Direction?
		L_E.....	4 11 37	.....	.....	.....	.....	
		L_N.....	4 11 39	.....	.....	.....	.....	
		M_N.....	4 11 47	.....	.....	*1,000	.....	
		M_E.....	4 12 00	.....	*500	.....	.....	
		F_E.....	4 14 25	.....	.....	.....	.....	
		F_N.....	4 15 00	.....	.....	.....	.....	

* Trace amplitude.

Porto Rico. *Vieques. Magnetic Observatory.* U. S. Coast and Geodetic Survey. F. L. Adams.

Lat., 18° 08′ 48″ N.; long., 65° 26′ 54″ W. Elevation, 19.8 meters.

Instruments: Two Bosch-Omori.

		V	T_0
Instrumental constants..	E	10	18
	N	10	18

(No earthquake recorded during September, 1917.)

Vermont. *Northfield. U. S. Weather Bureau.* Wm. A. Shaw.

Lat., 44° 10′ N.; long., 72° 41′ W. Elevation, 256 meters.

Instruments: Two Bosch-Omori, mechanical registration.

		V	T_0
Instrumental constants..	E	10	15
	N	10	16

(No earthquake recorded during September, 1917.)

Canada. *Ottawa. Dominion Astronomical Observatory.* Earthquake Station. Otto Klotz.

Lat., 45° 23′ 38″ N.; long., 75° 42′ 57″ W. Elevation, 83 meters.

Instruments: Two Bosch photographic horizontal pendulums, one Spindler & Hoyer 80k. vertical seismograph.

	V	T_0
Instrumental constants..	120	26

Date.	Character.	Phase.	Time.	Period T.	Amplitude. A_E	Amplitude. A_N	Distance.	Remarks.
			H. m. s.	*Sec.*	μ	μ	*km.*	
1917. Sept. 20	.....	eL.....	3 54 .. / 4 15 ..	18	.....	.....	.....	

TABLE 2.—*Instrumental reports, September, 1917*—Continued.

Date.	Character.	Phase.	Time.	Period T.	Amplitude. A_E	Amplitude. A_N	Distance.	Remarks.
Canada. *Toronto. Dominion Meteorological Service.* Lat., 43° 40′ 01″ N.; long., 79° 23′ 54″ W. Elevation, 113.7 meters. Subsoil: Sand and clay. Instrument: Milne horizontal pendulum, North; in the meridian. Instrumental constant.. T_0 18. Pillar deviation, 1 mm. swing of boom=0.50″.								
1917. Sept. 18	.....	P or S?	*H. m. s.* 22 04 30	*Sec.*	*μ*	*μ*	*km.*	
		L.....	22 20 48	.....	.....	.....	.....	
		eL...	22 26 06	.....	.....	.....	.....	
		M.....	22 33 48	.....	*300	.....	.....	
		F.....	23 11 54	.....	.....	.....	.....	
20	.....	eL.....	3 54 54	.....	.....	.....	.....	
		L.....	4 57 00	.....	.....	.....	.....	
		M.....	4 00 24	.....	*1,200	.....	.....	
		F!....	5 16 42	.....	.....	.....	.....	
24	.....	L.....	20 34 30	.....	.....	.....	.....	Air currents going on.
		L.....	20 35 42	.....	.....	.....	.....	
Canada. *Victoria, B. C. Dominion Meteorological Service.* Lat., 48° 24′ N.; long., 123° 19′ W. Elevation, 67.7 meters. Subsoil: Rock. Instrument: Wiechert, vertical; Milne horizontal pendulum, North. In the meridian. nstrumental constant.. T_0 18. Pillar deviation: 1 mm. swing of boom=0.54″.								
1917. Sept. 18	.....	S.....	*H. m. s.* 22 11 32	*Sec.*	*μ*	*μ*	*km.*	
		M.....	.....	.....	*50	.....	.....	L, M, and F?
20	.....	S?.....	3 33 17	.....	.....	.....	.....	
		L.....	3 38 15	.....	.....	.....	.....	
		M.....	3 45 41	.....	*400	.....	.....	
		F.....	4 03 31	.....	.....	.....	.....	
24	.....	P?....	20 30 06	.....	.....	.....	.....	Not recorded on vertical.
		S?....	20 41 01	.....	.....	.....	.....	
		L.....	20 50 56	.....	.....	.....	.....	
		M.....	21 02 20	.....	*300	.....	.....	
		F.....	21 19 42	.....	.....	.....	.....	

*Trace amplitude.

TABLE 3.—*Late seismological reports (Instrumental).*

Date.	Character.	Phase.	Time.	Period T.	Amplitude. A_E	Amplitude. A_N	Distance.	Remarks.
California. *Point Loma. Raja Yoga Academy.* F. J. Dick. Lat., 32° 43′ 03″ N.; long., 117° 15′ 10″ W. Elevation, 91.4 meters. Instrument: Two-component, C. D. West seismoscope.								
1917. July 12	.....	.....	*H. m. s.*	*Sec.*	*μ* *100	*μ* *100	*km.*	Tremors recorded during the 24 hours ending 15h on dates given.
14	.....	.....	.....	.....	*50	*100	.....	
29	.....	.....	.....	.....	*50	*100	.....	
Hawaii. *Honolulu. Magnetic Observatory.* U. S. Coast and Geodetic Survey. Frank Neuman. Lat., 21° 19′ 12″ N.; long., 158° 03′ 48″ W. Elevation 15.2 meters. Instrument: Milne seismograph of the Seismological Committee of the British Association. Instrumental constant.. T_0 18								
1917. Aug. 5	.....	eP.....	*H. m. s.* 16 01 18	*Sec.*	*μ*	*μ*	*km.*	
		S.....	16 09 48	.....	.....	.....	.....	
		eL.....	16 23 42	17	.....	.....	.....	
		M.....	16 30 30	.....	*700	.....	.....	
		C.....	17 10 ..	.....	.....	.....	.....	
		F.....	17 54 ..	.....	.....	.....	.....	
14	.....	e.....	8 39 54	.....	.....	.....	.....	
		M.....	8 42 48	18	*1,000	.....	.....	
		C.....	8 47 ..	.....	.....	.....	.....	
		F.....	9 01 ..	.....	.....	.....	.....	
16	.....	P.....	23 13 00	.....	.....	.....	.....	
		L.....	23 18 42	22	.....	.....	.....	
		M.....	23 31 06	.....	*200	.....	.....	
		C.....	23 49 00	.....	.....	.....	.....	
17	.....	F.....	0 24 00	.....	.....	.....	.....	
21	.....	e.....	23 00 00	.....	.....	.....	.....	
		M.....	23 02 30	18	*100	.....	.....	
		F.....	23 06 ..	.....	.....	.....	.....	
21	.....	e.....	23 34 48	.....	.....	.....	.....	
		M.....	23 38 12	18	*100	.....	.....	
		F.....	23 54 ..	.....	.....	.....	.....	
30	.....	e.....	3 47 06	.....	.....	.....	.....	
		eL.....	4 02 54	24	.....	.....	.....	
		M.....	4 08 42	.....	*500	.....	.....	
		C.....	4 14 ..	.....	.....	.....	.....	F lost in next quake.
30	.....	P.....	4 19 06	.....	.....	.....	.....	
		L.....	4 28 48	18	.....	.....	.....	
		M.....	4 51 12	.....	*2,100	.....	.....	
		C.....	4,56 48	.....	.....	.....	.....	
		F.....	7 10 ..	.....	.....	.....	.....	
31	.....	P.....	11 48 00	.....	.....	.....	.....	
		S.....	11 58 42	.....	.....	.....	.....	
		eL.....	12 14 48	25	.....	.....	.....	
		M.....	12 20 00	20	*3,000	.....	.....	
		C.....	12 28 00	.....	.....	.....	.....	
		F.....	14 34 ..	.....	.....	.....	.....	

*Trace amplitude.

TABLE 3.—*Late seismological reports (Instrumental)*—Continued.

Date.	Character.	Phase.	Time.	Period T.	Amplitude. A_E	Amplitude. A_N	Distance.	Remarks.

Canada. *Toronto. Dominion Meteorological Service.*

Lat., 43° 40′ 01″ N.; long., 79° 23′ 54″ W. Elevation, 113.7 meters. Subsoil: Sand and clay.

Instrument: Milne horizontal pendulum, North; in the meridian.

Instrumental constant..18. Pillar deviation, 1 mm. swing of boom=0.50″.

1917.			*H. m. s.*	*Sec.*	μ	μ	*km.*	
Aug. 5	.....	e?.....	16 08 18	.....	.....	.....	.....	Quake reported from North Island, N. Z.
		P.....	16 11 18	.....	.....	.....	.....	
		S.....	16 21 54	.....	.....	.....	.....	
		e.....	16 29 36	.....	.....	.....	.....	
		L.....	16 52 24	.....	.....	.....	.....	
		eL.....	16 55 30	.....	.....	.....	.....	
		M.....	17 01 36	.....	*2000	.....	.....	
		L.....	17 15 18	.....	.....	.....	.....	F lost attending instrument.
9	.....	L.....	16 29 48	.....	.....	.....	.....	
		L.....	16 32 18	.....	*50	.....	.....	
		F.....	16 54 06	.....	.....	.....	.....	
17	.....	L.....	0 00 24	.....	.....	.....	.....	
		eL.....	0 04 36	.....	.....	.....	.....	
		M.....	0 08 24	.....	*200	.....	.....	
		F.....	0 38 24	.....	.....	.....	.....	
21	.....	L.....	11 07 30	.....	.....	.....	.....	
		eL.....	11 08 54	.....	.....	.....	.....	
		M.....	11 12 06	.....	*100	.....	.....	
		F.....	11 31 24	.....	.....	.....	.....	
21	.....	P?.....	22 02 00	.....	.....	[illegible]	7,260?	
		S.....	22 10 42	.....	.....	.....	.....	
		eL.....	22 21 18	.....	.....	.....	.....	
		M.....	22 23 18	.....	*200	.....	.....	
		F.....	22 41 42	.....	.....	.....	.....	
30	.....	e?.....	3 25 12	.....	.....	.....	.....	e may not be seismic.
		P?.....	3 33 42	.....	.....	.....	.....	
		S.....	3 38 18	.....	.....	.....	.....	
		eL.....	3 41 24	.....	.....	.....	.....	
		eL.....	3 50 42	.....	.....	.....	.....	
		M.....	4 02 42	.....	*200	.....	.....	F merged into next quake.
30	.....	P.....	4 21 18	.....	.....	.....	.....	
		PR?..	4 30 18	.....	.....	.....	.....	
		S.....	4 32 18	.....	.....	.....	.....	
		L.....	4 40 30	.....	.....	.....	.....	
		M.....	5 37 24	.....	*1300	.....	.....	
		eL.....	5 57 42	.....	.....	.....	.....	
		eL.....	6 01 48	.....	.....	.....	.....	
		F.....	7 07 42	.....	.....	.....	.....	
31	.....	e?.....	11 35 54	.....	.....	.....	4,250	e may not be seismic.
		P.....	11 44 06	.....	.....	.....	.....	S waves well defined with large amplitude.
		iS.....	11 50 12	.....	.....	.....	.....	In Colombia.
		iL.....	11 59 18	.....	.....	.....	.....	
		iL.....	12 03 06	.....	.....	.....	.....	
		M.....	12 05 36	.....	*5300	.....	.....	
		iL.....	12 10 24	.....	.....	.....	.....	
		L_{rep}...	13 30 12	.....	.....	.....	.....	
		F.....	14 19 42	.....	.....	.....	.....	

* Trace amplitude.

Date.	Character.	Place.	Time.	Period T.	Amplitnde. A_E	Amplitnde. A_N	Distance.	Remarks.

Canada. *Victoria, B. C. Dominion Meteorological Service.*

Lat., 48° 24′ N.; long., 123° 19′ W. Elevation, 67.7 meters. Subsoil: Rock.

Instruments: Wiechert, vertical. Milne horizontal pendulum, North; in the meridian.

Instrumental constant..18. Pillar deviation: 1 mm. swing of boom=0.54″.

1917.			*H. m. s.*	*Sec.*	μ	μ	*km.*	
Aug. 5	.....	P?.....	16 16 58	.....	.....	.....	1,040?	Probably southeastern Pacific, about New Zealand.
		S?.....	16 27 57	.....	.....	.....	.....	
		L.....	16 41 13	.....	.....	.....	.....	
		M.....	17 01 24	.....	*300	.....	.....	
		F.....	18 16 58	.....	.....	.....	.....	
16	.....	P?.....	23 38 27	.....	.....	.....	3,590?	
		S.....	23 43 50	.....	.....	.....	.....	
		L.....	23 49 14	.....	.....	.....	.....	
		M.....	23 55 18	.....	*300	.....	.....	
17	.....	F.....	0 04 00	.....	.....	.....	.....	
21	.....	L?.....	11 15 37	.....	.....	.....	.....	
		M?.....	11 16 07	.....	*200	.....	.....	
21	.....	L?.....	22 44 38	.....	.....	.....	.....	
		L?.....	22 46 36	.....	.....	.....	.....	
		M.....	22 47 35	.....	*200	.....	.....	
		F.....	22 53 58	.....	.....	.....	.....	
30	.....	P?.....	4 04 19	.....	.....	.....	.....	
		S?.....	4 13 39	.....	.....	.....	.....	
		S?.....	4 27 25	.....	.....	.....	.....	Second S may belong to another quake.
		L.....	4 36 18	.....	.....	.....	.....	
		M.....	5 15 08	.....	*1000	.....	.....	
		F.....	6 58 24	.....	.....	.....	.....	
			VERTICAL		A_Z			
		P.....	*4 04 30*	*3*	.....	.....	.....	
		S.....	*4 12 18*	*6*	.....	.....	.....	
		L.....	*4 21 18*	*12*	.....	.....	.....	
		M.....	*4 48 18*	*24–28*	*2*	.....	.....	*F?*
31	.....	P.....	11 45 39	.....	.....	.....	6,840	Bogotá, Colombia.
		S.....	11 54 00	.....	.....	.....	.....	
		L.....	12 08 46	.....	.....	.....	.....	
		M.....	12 19 06	.....	*2000	.....	.....	
		F.....	14 01 53	.....	.....	.....	.....	
			VERTICAL		A_Z			
		P.....	*11 45 40*	*3*	.....	.....	*4,990*	
		S.....	*11 52 22*	*6–8*	.....	.....	.....	
		L.....	*12 06 58*	*30*	.....	.....	.....	
		M.....	*12 19 28*	*18–24*	*3*	.....	.....	

* Trace amplitude.

SEISMOLOGICAL DISPATCHES.[1]

Bogotá, Colombia, Sept. 1, 1917.

Severe earthquakes occurred in Colombia to-day. No serious damage reported. (Assoc. Press.)

Washington, D. C.

The State Department report of the earthquake at Bogotá, Colombia, says 300 houses were reported destroyed. A telegram to the department was sent from Baranquilla, where the number of casualties was unknown. (State Department.)

St. Paul, Minn., Sept. 3, 1917.

Earthquake shocks lasting as long as 20 seconds were reported tonight at St. Cloud, Little Falls, Brainerd, Staples, and other towns in the north central part of the State. In places the shock was heavy enough to break windows. (Assoc. Press.) [See Table 1, non-instrumental reports.]

Washington, D. C.

Official dispatches to-day from Bogotá, Colombia, say the earth shocks which began there August 29 continued intermittently until September 13. A few buildings were damaged and six persons were killed. (State Department.)

Santa Cruz, Cal., Sept. 24, 1917.

A slight earthquake was felt here to-day at 1.20 p. m. No damage done. (Assoc. Press.) [See Table 1.]

[1] Reported by the organization indicated and collected by the seismological station at Georgetown University, Washington, D. C.

SECTION VI.—BIBLIOGRAPHY.

RECENT ADDITIONS TO THE WEATHER BUREAU LIBRARY.

C. FITZHUGH TALMAN, Professor in Charge of Library.

The following have been selected from among the titles of books recently received as representing those most likely to be useful to Weather Bureau officials in their meteorological work and studies:

Annuario scientifico ed industriale. Anno 53, 1916.
Milano. 1917. 3p.l.,445p.,l. 19½ cm. [Meteorologia e fisica de globo per Lavoro Amaduzzi e per Filippo Eredia, p. [63]–104.

Brooks, Charles F[ranklin].
The deflective effect of the earth's rotation. (Reprinted from School science and mathematics, v.17, no.6, June, 1917, p.[517]–521.) 23 cm.

Coates, Henry.
Abstract of meteorological observations, Perth, 1914–15. 2 leaves. 14 x 23 cm.
Floods and droughts of the Tay Valley. cover-title. 26 p. 4 plates. fold. diagram. 21½ cm. (Reprinted from the Transactions of the Perthshire society of natural science, v. 6, pt. 3, 1916.)
Note on old weather record found amongst the MSS. of the Antiquarian museum. cover-title. 8p. tables. 21cm. (Reprinted from the Transactions of the Perthshire society of natural science, v.6, pt.3, 1916.) [Record kept from Feb., 1754, to June, 1774.]

Denmark. Meteorologiske institut.
Overfladevandets manndelige middeltemperatur i Atlanterhavet nord for 50° N. br. (Med 14 kort M.M.) Monthly mean temperatures of the surface water in the Atlantic, north of 50° N. lat. (with 14 charts, etc.) Tillaegsheíte til Nautisk meteorologisk aarbog. Appendix to the Nautical meteorological annual. Kjøbenhavn, 1917. 21p. tables. charts. 31½ cm.

Dorno, C.
Atmosphärisch-optische Störungen (Herbst 1911 bis Februar 1917). [2] p. 29½ cm. (Abdruck aus den Astron. Nachr. Nr. 4899. Band 205. August, 1917.) [See this REVIEW for October, 1917.]

Eredia, Filippo.
Le neve in Tripolitani. Roma. 1917. 11p. plates. 23½ cm. (Estratto dal Bollettino d'informazioni, anno 4, n.10–12.) At head of title: Ministero delle colonie.

France. Bureau central météorologique.
Annalés. Année 1910. I. Mémoires. Paris. 1915. xxxiv, l., 122 p., 2 l. tables. charts 32½ cm. [Table générale par nom d'auteurs des mémoires contenus dans les tomes 1 des Annales ... pour les dix années 1901–1910, p. [115]–120. Table analytique générale ... 1901–1910, p.[121]–122.]
Annales. Année 1911. I. Mémoires. Paris. 1916. xxxvi, l, 247 p., 2 l. tables. charts. maps. 32½ cm.

Gachons, André des.
Prévision du temps. illus. 33 cm. [Excerpted from Larousse mensuel, v.11, Sept. 1917, p. 242–244.]

Iowa. Agricultural experiment station.
The weather and honey production. Ames, Iowa. March, 1917. 26 p. incl. 10 tables. chart. 22 cm. Bulletin no. 169.

Liverpool. Observatory.
Report of the director of the Observatory to the Marine committee, and meteorological results deduced from the observations taken at the Liverpool observatory, Bidston, Birkenhead, in the year 1916. Published by order of the Mersey docks and harbour board. Liverpool. 1917. 47p. incl. tables. 24cm.

McEwen, George F[rancis].
Summary and interpretation of the hydrographic observations made by the Scripps institution for biological research of the University of California 1908 to 1915. Berkeley. [1916] cover-title, tables. diagrams (part. fold.) 27½ cm. (University of California publications in zoology, vol. 15, no.3. p.255–356, plates 1–38. December 6, 1916.) [Literature cited, p. 280.]

Marvin, Charles F[rederick].
Applied meteorology and the work of the Weather Bureau. [Excerpted from Proceedings of the Ohio academy of science, v.6, pt.5. Annual report, 25th meeting 1915, p.265–276.] 23 cm.

Matthews, R. Borlase.
The aviation pocket-book for 1917: a compendium of modern practice and a collection of useful notes, formulæ, rules, tables, and data relating to aeronautics; 5th ed. rev. & enl. London. 1917. xix, 300 p. tables. diagrams (part. fold.) 17½ cm. Bibliography, p.249–259.

Mizusawa. International latitude observatory.
Annual report of the meteorological and the seismological observations for the 1916 ... Mizusawa. 1917. cover-title. [2] 40 p. incl. tables. 30 cm.

Moye, Marcel.
Réception, interprétation et utilisation des radiogrammes météorologiques. Montpellier. 1914. 26 p. illus. tables. 9 figures. 24 cm.
Réseau pluviométrique de l'Espagne orientale. [Excerpted from Bulletin de la Société astronomique Flammarion de Montpellier. 44me année, Mars, 1916, p. 6–10.] 24½ cm.

Ohio. Agricultural experiment station.
Ohio weather for 1916, by W. H. Alexander and C. A. Patton. Wooster, O. 1917. cover-title. tables. maps. 23 cm. (Bulletin 314, June, 1917, p. 617–697.)

O'Malley, L. S. S.
Bengal, Bihar and Orissa Sikkim. Cambridge [Eng.] 1917. xii, 517 p. illus. fold. map. 21 cm. (Provincial geographies of India.) [Climate, p.[63]–71.]

Pennsylvania. Water supply commission.
Water resources inventory report. Part 5. Precipitation. Harrisburg. 1916. 205 p. tables. figures. fold. map. 23 cm.

Rodger, Alexander M.
Abstract of meteorological observations, Perth. 1913. leaf. 14½ x 22½ cm.
Meteorological observations in Perth. charts. tables. (part. fold.) 21½ cm. (Appendix to Proceedings of the Perthshire society of natural science, Dec. 1909, p. xliii–lviii.)
Meteorological observations, Perth. Mean daily values and extreme readings of the months and years (1883 to 1912, inclusive). 30 years. leaf. 14 x 22 cm.

Rolt-Wheeler, Francis [William].
The boy with the U. S. Weather men. Boston. [c1917] x, l, 336 p. front. plates. 20½ cm. (U.S.Service series.)

[San Francisco. Panama-Pacific international exposition, 1915. Chilean section.]
Chile. [Santiago de Chile] 1915. [9]–391 p. plate. illus. tables. 26 cm. [Climate, p. 24–29.]

Sim, John M.
Modification of South African rainfall. (Excerpted from the South African journal of science, v.13, no.7, Feb. 1917, p. 318–326.) 26½ cm. [Supposed decrease in rainfall of South Africa in past 100 years and change in its character.]

Smith, J[ohn] Warren.
President's address. Agricultural meteorology. 5 charts. 9 tables. 23 cm. (Excerpted from Proceedings of the Ohio academy of science, v.6, pt.5. Annual report, 25th meeting, 1915, p.241–264.)

Southport. Meteorological department. Fernley observatory.
Report and results of observations for the year 1916, by Joseph Baxendell. Southport. 1917. 23 p. incl. tables. 24½ cm. At head of title: Twenty-fifth annual report. Forty-fifth complete year of observations.

U. S. Naval aeronautical school, Pensacola, Fla.
Outline of practical and theoretical course of instruction in free and kite ballooning as used at the Naval aeronautical school, Pensacola, Florida. [Pensacola. 1917.] 77 no. leaves. incl. plates. illus. figures. tables. 23 cm.

Walkden, S. L.
Aeroplanes in gusts. Soaring flight and the stability of aeroplanes; 2d ed. greatly enl. London. 1913. xxv,280p. front. diagrams. charts (part. fold.) 22 cm.

RECENT PAPERS BEARING ON METEOROLOGY AND SEISMOLOGY.

C. FITZHUGH TALMAN, Professor in Charge of Library.

The following titles have been selected from the contents of the periodicals and serials recently received in the Library of the Weather Bureau. The titles selected are of papers and other communications bearing on meteorology and cognate branches of science. This is not a complete index of the meteorological contents of all the journals from which it has been compiled. It shows only the articles that appear to the compiler likely to be of particular interest in connection with the work of the Weather Bureau.

Astronomical society of the Pacific. Publications. San Francisco. v. 29. October, 1917.

Campbell, W. W. The war and the weather. p. 200–202.

Aviation. New York. v. 3. October 1, 1917.

Taylor, G. I. Fog conditions. p. 311–313.

Engineering news-record. New York. v. 79. 1917.

Run-off equaled rainfall. p. 699. (Oct. 11.) [A "record" 24-hour rainfall for January in Chicago.]

Ingberg, S. H. Tornado effects on structures in three recent storms. Suggestions as to the design of dwellings and small structures to resist high winds, deduced from observations of buildings wrecked by tornadoes in middle western States. p. 733–736. (Oct. 18.)

Franklin institute. Journal. Philadelphia. v. 184. October, 1917.

Humphreys, W[illiam] J[ackson]. Physics of the air. (Chapter 7.) p. 527–551.

Geographical review. New York. v. 4. October, 1917.

Brooks, Charles F. The severe winter of 1917 in Scandinavia. p. 319–320. [Abstract from La Nature, with comments by abstractor.]

Meterological society of Japan. Journal. 36th year. 1917.

Fujiwhara, Sakuhei. The ondometer. A newly designed instrument for measuring the direction, velocity, period, and length of the waves of the sea. p. 81–84. [Used at shore stations to study waves produced by typhoons.]

Hasegawa, K. Epicenter distance and the duration of the preliminary tremor of an earthquake of very near origin. p. 33—35.

Nature. London. v. 100. September 20, 1917.

Allen, F. J. The audibility of distant gunfire. p. 44.

C., W. E. Bird migration in central Switzerland in relation to meteorological conditions. p. 47–48. [Abstract of memoir by K. Bretscher.] [This REVIEW, p. 451.]

Royal astronomical society of Canada. Journal. Toronto. v. 11. September, 1917.

Patterson, J. Long-range forecasting and other weather illusions. p. 261–280.

Klotz, Otto. The rainbow. p. 292–296.

Science abstracts. London. v. 20. July 30, 1917.

Masini, A. Factors influencing the condensation of aqueous vapor in the atmosphere. p. 261–262. [Abstract from Nuovo cimento.] [See this REVIEW, August, 1917, p. 412.]

Scientific American supplement. New York. v. 84. 1917.

Hawke, E. L. Rainfall and gunfire. p. 227. (Oct. 13.) [Abstract of article by Angot. Repr. from Nature.] [See this REVIEW, p. 450.]

Asher, James. New thermometer scale. p. 262. (Oct. 27.) [Author says he suggested in 1887 the scale recently proposed by McAdie.]

Air pollution in London. p. 267. (Oct. 27.)

Scottish geographical magazine. Edinburgh. v. 33. September, 1917.

Knott, C. G. Further studies on earthquake waves. p. 406–422.

Terrestrial magnetism. Baltimore. v. 22. September, 1917.

Swann, W. F. G. Note concerning the measurement of ionic density on the top of a tower. p. 125–127.

Störmer, Carl. Corpuscular theory of the aurora borealis. p. 97–112.

Swann, W. F. G. Gockel's recent atmospheric-electric observations in Switzerland. p. 135–138. [Abstract of work by Gockel.]

France. Bureau central météorologique. Annales. Paris. Année 1911, no. 1.

Angot, Alfred. Études sur le climat de la France. p. 109–235.

Astronomie. Paris. 31 année. Juillet, 1917.

Visibilité des ondes sonores? p. 248–249. [Several cases of visible sound-waves ("flashing arc") in connection with cannonading.]

Académie des sciences. Comptes rendus. Paris. t. 165. 3 septembre, 1917.

Mascart, Jean. Hiver 1917: halos et arc-en-ciel. p. 343–345. [Mentions a doubtful case of the tertiary rainbow.]

Reale accademia dei Lincei. Atti. Roma. v. 26. 1º semestre. 3 giugno, 1917.

Chistoni, C[iro]., & Malladra, A[lessandro] Singolare precipitazione acquea osservata al Vesuvio. p. 606–607.

Eredia, Filippo. Correlazione tra la temperatura dell'Italia e dell'Egitto. p. 607–609.

SECTION VII.—WEATHER AND DATA FOR THE MONTH.

THE WEATHER OF SEPTEMBER, 1917.

P. C. DAY, Climatologist and Chief of Division.
[Dated: Climatological Division, Weather Bureau, Nov. 1, 1917.]

PRESSURE AND WINDS.

The distribution of the mean atmospheric pressure over the United States and Canada, and the prevailing direction of the winds for September, 1917, are graphically shown on Chart VII, while the means at the several stations, with the departures from the normal, are shown in Tables I and III.

The month opened with pressure above the normal throughout the Atlantic Coast States, in the northern part of the Rocky Mountains and of the Great Plains region. It was below the normal in the upper Lakes Region and the Pacific Coast States. Elsewhere it was near the seasonal average.

Except for the occasional passage of a moderately low area across the country, the pressure was above the normal from the Rocky Mountains eastward during the first and second decades of the month. However, during the third decade it was below the normal much of the time in most northern districts; it was likewise low in the South during the latter half of the decade, due to the tropical hurricane which visited western Florida and southern Alabama on the 28th. (See pp. 457–9.) Throughout the central portions of the country the pressure was above the normal during the greater part of the last decade. The month closed with pressure below the normal from the Great Lakes to the eastern Gulf States and to the eastward, while it was generally above from the Mississippi Valley to the Rocky Mountain region. Elsewhere it was near the normal.

For September as a whole the barometric pressure averaged above the normal throughout the country, except in Florida, where it was slightly below. The departures were generally small, although somewhat pronounced in the upper Lakes Region and the upper Mississippi and the Missouri Valleys.

The distribution of the HIGHS and LOWS generally favored northerly winds throughout the Atlantic coast, eastern Gulf States, and the Ohio Valley; southerly winds were frequent in northwestern New England, over much of the Lakes Region, and generally from the Mississippi Valley to the Rocky Mountains. Elsewhere variable winds prevailed. The hurricane of the 28th caused winds with a maximum 5-minute velocity of 103 mis./hr. at Pensacola on that date.

TEMPERATURE.

At the beginning of September cool weather, with heavy frost, prevailed in the middle and upper portions of the Missouri Valley. During the next few days this weather extended eastward over most of the northern sections, but to the south warmer weather obtained. From the 6th to the 8th, another cool area overspread the northern third of the country from the Dakotas to the Atlantic coast. After a few days of somewhat warmer weather, a third decidedly cool area accompanied by heavy frost and freezing temperatures, moved southward from the Canadian Northwest; on the 11th it overspread the Eastern and Central States, with general frosts north of the 40th parallel and east of the upper Mississippi Valley. Cool weather then continued in the Atlantic States for several days, but at the same time warmer weather prevailed in Wyoming and adjacent States, while in most other central and western districts temperatures were close to normal. About the middle of the month cool weather again prevailed from Nevada to Montana, with occasional light frost; but on the 18th the temperature became high in the interior of the Pacific States, in the Dakotas and Minnesota; in the southeastern districts it was rather low. About the 20th cooler weather overspread the Missouri and upper Mississippi Valleys and, extending slowly eastward, reached the New England States on the 23d-24th. About this time warm weather prevailed over the central and northern plains, and cooler weather was experienced in Nevada and Utah, which during the next several says extended over the Rocky Mountain States and the upper Missouri Valley; likewise the weather in the Atlantic Coast States was cool for the season. During the closing days of the month cool weather obtained in the northern border States, while in California and from the middle Plains States to the southern Rocky Mountains Region it was warm for the season.

For the month as a whole the temperature was below normal east of the Mississippi River and in Iowa, Minnesota, and the northern portions of North Dakota and Montana. Elsewhere it was above the seasonal average. In Oregon and west-central California the average was 3 degrees or more above normal, while from the Lower Lakes southeastward to the Atlantic it was about 3 degrees below.

PRECIPITATION.

The month opened with cloudy, showery weather in portions of the Atlantic Coast States and the northern districts from Montana to Lake Superior, and during the next few days widely distributed rainfall occurred over the upper Mississippi Valley and Lakes Region, and from the Ohio Valley eastward and southward to the Atlantic and Gulf coasts, with large amounts locally in Texas, Iowa, and the southern Appalachian Mountains.

Rather heavy rains occurred on the 5th and 6th from Iowa to the Lower Lakes; on the 7th in the northeastern districts; and on the 8th in the Middle Atlantic States, the Ohio and upper Mississippi Valleys. In the western portions of Washington and Oregon the severe drought was broken. Irregularly distributed rains fell on the 11th and 12th in the South Atlantic and East Gulf States, the far Northwest, in Utah and Texas; on the 13th and 14th considerable rain occurred in the South Atlantic and East Gulf States, the upper Lakes Region, the upper Mississippi Valley, the northern and middle Rocky Mountain and Plateau regions, and North Pacific States. The rainy weather in the South Atlantic and East Gulf States continued until the 16th, with high winds and torrential rains over eastern North Carolina, and some rain occurred in the Middle Atlantic States and in eastern Texas on the 17th. During the next several days considerable rain fell in Florida and moderate amounts in Missouri and the upper Mississippi Valley. About the 22d and 23d good rains fell in the northern half of California and in parts of the northern Plateau region, and scattered showers occurred in the Lakes Region, the Ohio Valley, and Atlantic States, and rain continued, in Florida, almost every day until the end of the month. Light rains fell in portions of the Cotton Region on the 25th and 26th, and on the 27th and 28th there was rain in practically all eastern districts, with heavy amounts in the East Gulf States and southern Appalachians in connection with the tropical hurricane passing over western Florida on the 28th. Thence it continued its northeastward course, losing energy rapidly,

but accompanied by torrential rains over most of southern Alabama and extreme western Florida. September closed with heavy rains in the Carolinas, Georgia, and Florida, with light falls in the Lakes Region and to the eastward, and fair weather elsewhere, generally.

For the month as a whole, the precipitation was heavy over considerable portions of the South Atlantic and East Gulf States, and small areas in southeastern Iowa and northwestern Washington. Elsewhere rainfall was, as a rule, moderate to light, and quite extensive areas in California, Nevada, and northwestern Utah received no precipitation during the month.

RELATIVE HUMIDITY.

For the month as a whole the atmosphere was relatively drier than usual for September throughout much of the coastal portion of the New England, Middle Atlantic, and Gulf States, and likewise in California and Nevada. Elsewhere the relative humidity was generally above the normal, although in many small irregularly distributed areas it was lower than the seasonal average.

GENERAL SUMMARY.

On the whole, during September, 1917, the weather was favorable for farm work. Crops matured satisfactorily in the West and Northwest under generally favorable weather conditions, but it was too cool in the Central and Eastern States for the best development of vegetation; corn and other fall crops matured slowly. Plowing and seeding of winter grains made good progress.

The weather was too dry in some sections and too cool in nearly all portions of the Cotton Belt for the favorable development of cotton. Late potatoes and truck crops made good progress in most sections, and the ripening of fruit progressed satisfactorily. The weather was generally favorable for meadows and pastures, and live stock was in good condition.

Average accumulated departures for September, 1917.

Districts.	Temperature.			Precipitation.			Cloudiness.		Relative humidity.	
	General mean for the current month.	Departure for the current month.	Accumulated departure since Jan. 1.	General mean for the current month.	Departure for the current month.	Accumulated departure since Jan. 1.	General mean for the current month.	Departure from the normal.	General mean for the current month.	Departure from the normal.
	°F.	°F.	°F.	In.	In.	In.	0-10		P. ct.	
New England	57.9	−2.6	−11.8	1.84	−1.30	−1.50	4.6	−0.6	79	−2
Middle Atlantic	63.1	−3.4	−6.8	2.56	−0.80	−3.10	5.2	+0.5	66	−12
South Atlantic	70.8	−2.3	+3.3	5.99	+0.40	−6.30	6.1	+1.5	82	+1
Florida Peninsula	80.1	−0.6	+2.8	10.76	+2.80	−5.10	6.1	+0.9	80	−1
East Gulf	73.8	−1.1	+3.2	4.87	+1.50	−2.20	5.3	+0.8	77	−1
West Gulf	76.0	+0.2	+3.6	2.44	−1.20	−9.90	5.3	+1.2	73	−1
Ohio Valley and Tennessee	66.5	−1.5	−12.6	2.30	−0.50	+1.90	4.0	−0.4	75	+1
Lower Lakes	60.2	−2.9	−20.4	1.88	−0.90	−0.30	6.7	+1.8	74	0
Upper Lakes	57.4	−1.7	−25.2	2.32	−0.90	−3.10	5.0	−0.2	80	+2
North Dakota	56.9	−0.8	−13.9	1.12	−0.30	−8.20	5.0	+0.6	72	+3
Upper Mississippi Valley	63.5	−1.2	−19.7	2.77	−0.50	−1.40	4.5	+0.1	77	+2
Missouri Valley	65.6	+0.1	−8.2	2.51	−0.10	−3.20	4.4	+0.2	72	+4
Northern slope	58.4	+0.9	−17.6	1.43	+0.30	−1.00	4.3	+0.2	63	+4
Middle slope	68.6	+1.0	−4.8	1.21	−0.80	−5.30	3.3	−0.1	65	+4
Southern slope	73.7	+1.0	+5.0	1.41	−1.20	−5.20	3.9	+0.3	49	−16
Southern Plateau	72.0	+1.5	−7.9	0.40	−0.50	−1.50	3.2	+0.7	48	+6
Middle Plateau	63.5	+1.1	−27.0	0.51	−0.20	−1.50	2.5	−0.5	40	−2
Northern Plateau	64.0	+2.8	−15.2	1.48	+0.70	−0.70	3.9	+0.2	50	0
North Pacific	59.2	+1.6	−9.4	2.25	−0.20	−5.70	6.4	+1.0	82	+3
Middle Pacific	65.1	+1.7	−5.8	0.36	−0.20	−6.40	3.2	0.0	51	−12
South Pacific	70.5	+3.2	+2.5	T.	−0.20	−2.50	2.0	−0.7	62	−4

WEATHER CONDITIONS OVER THE NORTH ATLANTIC OCEAN DURING SEPTEMBER, 1916.

The data presented are for September, 1916, and comparison and study of the same should be in connection with those appearing in the REVIEW for that month.

Chart IX (XLV—94) shows for September, 1916, the averages of pressure, temperature, and prevailing direction of the wind at 7 a. m., 75th meridian time (Greenwich Mean Noon), together with notes on the locations and courses of the more severe storms of the month.

PRESSURE.

The distribution of the average monthly pressure, as shown on Chart IX, was similar to the normal over the entire ocean, although the isobar of 29.85 inches that marks the southern limits of the Icelandic LOW, was about 5° north of its usual position.

The North Atlantic or Azores HIGH, with a crest of 30.18 inches, was practically normal in all respects, and the continental HIGH, with a crest of 30.11 inches was central near Lynchburg, Va., extending as far east as the 67th meridian.

The pressure changes from day to day showed the usual autumnal variations in the higher latitudes, and in one 5-degree square as far south as the Azores, the barometric readings ranged from 30.45 inches on the 4th to 29.81 inches on the 30th. The following table gives for a number of selected 5-degree squares, the average pressure for each of the three decades of the month as well as the highest and lowest individual readings reported during the month within the respective squares.

Pressure over the North Atlantic during September, 1916, by 5-degree squares.

Position of 5-degree squares.		Decade means.			Extremes.			
					Highest.		Lowest.	
Latitude.	Longitude.	I	II	III	Pressure.	Date.	Pressure.	Date.
°	°	Inches.	Inches.	Inches.	Inches.	Sept.	Inches.	Sept.
60-65 N	20-25 W	29.88	29.95	29.72	30.33	9	29.36	24
60-65 N	5-10 E	30.04	29.62	30.08	30.33	7	29.13	13
55-60 N	25-30 W	29.94	30.04	29.53	30.36	13	29.30	25
55-60 N	0- 5 E	30.08	29.77	30.11	30.40	9	29.69	4
50-55 N	55-60 W	29.91	30.02	29.81	30.34	11	29.48	26
50-55 N	30-35 W	30.05	30.00	29.57	30.32	9	29.33	30
45-50 N	65-70 W	30.00	30.13	29.83	30.28	10	29.59	25
45-50 N	15-20 W	30.30	30.28	29.72	30.48	9,10	29.50	25
40-45 N	70-75 W	30.07	30.18	29.96	30.50	11	29.78	2,8
40-45 N	25-30 W	30.34	30.16	29.88	30.52	10	29.58	30
35-40 N	50-55 W	30.21	29.99	30.14	30.31	1	29.80	15
35-40 N	0- 5 W	30.04	30.08	29.97	30.21	12	29.80	28
30-35 N	40-45 W	30.26	30.07	30.13	30.32	7,9	29.90	15
25-30 N	30-35 W	30.18	30.12	30.08	30.32	4	29.97	24
20-25 N	45-50 W	30.10	30.06	30.09	30.24	26	29.90	30
15-20 N	15-20 W	29.96	30.03	30.01	30.12	14	29.87	10
10-15 N	25-30 W	29.95	30.02	29.98	30.16	23	29.86	10

The mean and extreme pressures presented in the above table are based on the daily pressure values, determined by interpolation, for each square as given on the MS. daily synoptic charts of the North Atlantic compiled by the Marine Section of the Weather Bureau.

GALES.

The month of September is usually characterized by uncertain and variable weather over the North Atlantic, and while the normal percentage of gales is not high, there is a large range in the number reported during different years.

For September, 1916, the number of gales was somewhat below the normal over the entire ocean with the exception of a small area near St. Johns, N. F., and in

the waters adjacent to the American coast, between the 30th and 40th parallels.

In an article that appeared in the MONTHLY WEATHER REVIEW for December, 1916, **44**: 686–688, "Hurricanes of 1916 and Notes on Hurricanes of 1912–1915," by Mr. R. H. Weightman, two West Indies hurricanes that appeared in September, 1916, were described and plotted (ibid., chart XLIV—152). These were of comparatively light intensity, and as few vessel reports were received from the vicinity, no attempt has been made to show the tracks on accompanying Chart IX. On September 1 a LOW with a minimum barometric reading of 29.37 inches was central near the Faroe Islands. Vessels in its southern quadrants reported southwesterly gales of from 40 to 50 miles an hour; no reports were received from the north of the 60th parallel.

From the 2d to the 5th there were no cyclonic disturbances of any consequence. On the 6th one of limited extent and moderate intensity was central near latitude 44°, longitude 44°, where moderate southwesterly gales were encountered. This LOW moved rapidly in a northeasterly direction, and on the 7th and 8th occupied a comparatively large area between the 55th and 65th parallels, and the 14th and 30th meridians, strong gales prevailing on the latter date near the center. On the 9th there was a disturbance near Cape Ray, N. F., where the barometer reading was 29.64 inches; no specially heavy winds were recorded, and fog prevailed off the Banks of Newfoundland. From the 10th to the 19th this area of low pressure remained within the territory between the 40th and 50th parallels, and the 35th meridian and the Canadian coast, moving slightly from day to day in an irregular manner, within these limits. On the 10th a HIGH with a crest of 30.51 inches was central near latitude 45°, longitude 25°; the steep gradients between this area and the LOW that on this date was central near St. Johns, N. F., was responsible for moderate to strong southwesterly gales that were encountered along the middle portion of the steamer lanes. The strongest wind of the month occurred on the 12th, when one vessel about 200 miles northeast of St. Johns, reported a northeasterly gale of 65 miles an hour, while a number of vessels in the same general locality, also experienced winds of gale force. Between the 13th and 15th a few scattered reports were received showing winds of gale force between the 50th meridian and the American coast, while from the 16th to the 22d, light to moderate winds were reported over the entire ocean.

On Chart III (XLIV—115) "Tracks of centers of low areas, September, 1916", a LOW (*I* on Chart IX, XLV—94) is shown that first appeared on the morning of the 14th, in northwestern Alberta. This moved in an easterly direction with a comparatively slow rate of translation, and on the morning of the 24th the center was near Father Point, Quebec, where the barometric reading was 29.54 inches. On the same day a second LOW was central near latitude 55°, longitude 25°, and a number of vessels in the southwesterly quadrants encountered northwesterly gales of from 40 to 55 miles an hour. On the 25th and 26th, LOW *I* was central near Cape Ray, N. F., moderate winds prevailing on both dates in that vicinity. On the 25th the second LOW was in practically the same position as on the day before, northwesterly gales still being encountered in the same territory. On the 26th this LOW had moved about 5° toward the east, the winds having moderated in force. On the 27th the center of LOW *I* was near St. Johns, N. F., conditions of wind and weather remaining about the same as on the day before. The path of this disturbance then curved sharply toward the north, and on the 28th was central near latitude 52°, longitude 40°, light winds and fog being reported from that locality, while moderate northwesterly gales covered a small area about 200 miles southeast of St. Johns. This LOW then moved rapidly in an easterly direction and on the 29th was near latitude 52°, longitude 24°; but it had lost greatly in intensity, as no heavy winds were reported. It then turned sharply toward the south, and on the 30th was 150 miles from its position of the previous day, and had gained somewhat in intensity, as northerly gales prevailed over a limited area immediately west of the center.

TEMPERATURE.

The average monthly temperature of the air over the ocean during September, 1916, was considerably above the normal in the vicinity of the northern steamer lanes, and over the region north of the 35th parallel, between the 35th meridian and the European coast. In the lower latitudes the departures were small, ranging from +2 degrees in the eastern part of the northeast trade region to −1 degree in the waters adjacent to the south coast of Cuba, while the temperatures in the Gulf of Mexico were practically normal.

The following table gives the mean departures for September, 1916, at a number of Canadian and United States Weather Bureau stations on the Atlantic and Gulf coasts.

	°F.		°F.
St. John's, N. F.	+0.6	Norfolk, Va.	−1.4
Sidney, C. B. I.	+3.1	Hatteras, N. C.	−1.5
Halifax, N. S.	+1.5	Charleston, S. C.	−1.1
Eastport, Me.	+0.6	Key West, Fla.	−0.8
Portland, Me.	−0.8	Tampa, Fla.	+1.3
Boston, Mass.	+2.3	Mobile, Ala.	+0.5
Nantucket, Mass.	+0.7	New Orleans, La.	+1.3
Block Island, R. I.	−0.8	Galveston, Tex.	0.0
New York, N. Y.	−0.5	Corpus Christi, Tex.	+0.4

The lowest temperature recorded during the month was 48° and occurred on the 12th in the square that includes the east coast of Labrador, and also on the same date in the waters adjacent to the south coast of Greenland. The highest temperature for the same locality was 57°, recorded on a number of different days.

FOG.

Off the Banks of Newfoundland, where the number of days on which fog occurs is usually the greatest, fog was reported during September, 1916, on 8 days, a percentage of 27, which is slightly below the normal. About the same conditions also held true along the New England coast and over the greater part of the steamer lanes.

Winds of 50 mis./hr. (22.4 m./sec.), or over, during September, 1917.

Station.	Date.	Velocity.	Direction.	Station.	Date.	Velocity.	Direction.
		Mis./hr.				*Mis./hr.*	
Buffalo, N. Y.	29	54	sw.	New York, N. Y.	30	51	nw.
Cheyenne, Wyo.	27	50	w.	North Head, Wash	6	54	se.
Fort Worth, Tex.	26	52	n.	Pensacola, Fla.	28	103	se.
Louisville, Ky.	7	58	se.	Do.	29	65	nw.
Mobile, Ala.	28	98	n.	Pittsburgh, Pa.	6	58	n.
Mount Tamalpais, Cal.	7	54	nw.	Point Reyes Light, Cal.	13	60	nw.
Do.	12	58	nw.	Salt Lake City, Utah	4	52	w.
Do.	14	54	nw.	Sand Key, Fla.	25	50	se.
Nantucket, Mass.	17	66	ne.	Do.	26	60	se.
Do.	18	67	ne.	San Juan, P. R.	21	52	ne.

CONDENSED CLIMATOLOGICAL SUMMARY.

In the following table are given for the various sections of the climatological service of the Weather Bureau the monthly average temperature and total rainfall; the stations reporting the highest and lowest temperatures, with dates of occurrence; the stations reporting the greatest and least total precipitation; and other data as indicated by the several headings.

The mean temperature for each section, the highest and lowest temperatures, the average precipitation, and the greatest and least monthly amounts are found by using all trustworthy records available.

The mean departures from normal temperatures and precipitation are based only on records from stations that have 10 or more years of observations. Of course the number of such records is smaller than the total number of stations.

Condensed climatological summary of temperature and precipitation by sections, September, 1917.

Section.	Temperature.								Precipitation.					
	Section average.	Departure from the normal.	Monthly extremes.						Section average.	Departure from the normal.	Greatest monthly.		Least monthly.	
			Station.	Highest.	Date.	Station.	Lowest.	Date.			Station.	Amount.	Station.	Amount.
	°F.	°F.		°F.			°F.		In.	In.		In.		In.
Alabama	73.1	−2.0	3 stations	98	9	2 stations	40	13†	6.42	+2.87	Robertsdale	23.33	Livingston	1.65
Arizona	73.9	+1.0	Sentinel	114	4	2 stations	21	27	1.23	+0.01	Springerville	4.77	Gila Bend	0.00
Arkansas	71.8	−1.9	Brinkley	99	1	Dutton	37	29	1.76	−1.87	Springbank	5.26	Marked Tree	0.06
California	69.0	+0.5	Greenland Ranch	115	1	Bridgeport	19	25	0.10	−0.39	Crescent City	1.76	68 stations	0.00
Colorado	57.8	+0.5	Fort Morgan	99	10	Dillon	15	27	1.33	+0.02	Burlington	4.40	Grandlake	T.
Florida	78.4	−1.1	Tallahassee	101	9	Molino	49	13	7.73	+0.48	Miami	18.71	Melrose	2.27
Georgia	72.8	−2.2	Bambridge	102	9	Ramhurst	43	13	5.63	+2.09	Tallapoosa	10.79	Quitman	1.49
Hawaii (August)	74.6	−0.1	2 stations	92	8	Volcano Observatory	50	8	2.83	−3.53	Waiakamoe	10.83	7 stations	0.00
Idaho	59.4	+3.4	3 stations	99	10†	Fish Lake	16	1	1.50	+0.40	St. Michael's Priory	4.59	American Falls	0.03
Illinois	65.0	−2.1	Du Quoin	96	2	Sycamore	30	11	2.62	−0.95	Mascoutah	7.14	Fairfield	0.35
Indiana	64.4	−2.6	Rome	95	6	Laporte	26	11	1.73	−1.30	Connersville	4.55	Tab	0.22
Iowa	62.6	−0.8	Clarinda	97	3	Sibley	28	27	2.90	−0.46	St. Charles	8.68	Audubon	0.39
Kansas	69.1	0.0	St. Francis	103	3	4 stations	33	27	2.38	−0.42	Lawrence	5.73	Dodge City	0.36
Kentucky	67.7	−2.9	Paducah	98	5	Loretto	34	30	2.56	−0.14	Catlettsburg	5.52	Mayfield	0.45
Louisiana	75.4	−2.2	Angola	103	8	Kelly (near)	44	29	2.97	−1.10	Cinclare	10.79	Tallulah (near)	0.20
Maryland-Delaware	62.6	−4.8	Frederick, Md	93	2	2 stations	27	11	2.73	−0.43	State sanatorium	4.96	Cheltenham	1.31
Michigan	57.6	−2.7	Lapeer	89	2	Seney	23	11	1.91	−1.02	Monroe	4.87	Cheboygan	0.12
Minnesota	57.4	−0.9	St. Peter	90	17	Roseau	17	10	1.10	−0.67	Campbell	6.40	Argyle	0.55
Mississippi	73.8	−2.0	Brookhaven	99	9	Cleveland	41	12	2.66	−1.02	Pascagoula	8.07	Jackson	0.44
Missouri	67.9	−1.2	Caruthersville	101	1	Ironton	33	12	2.78	−1.09	Mount Vernon	5.23	Sikeston	0.05
Montana	56.8	+1.8	Ovando	98	20†	Bowen	14	15	1.62	+0.25	Havre	4.58	Hercules Ranch	0.00
Nebraska	64.2	+0.5	Beaver City	104	3	Gordon	27	20	2.69	+0.55	Elm Creek	7.17	Harrison	0.37
Nevada	62.1	+1.3	Logan	105	5	Paradise Valley	21	14	0.22	−0.14	Pioche	1.51	11 stations	0.00
New England	57.1	−3.0	Patten, Me	90	24	Somerset, Vt	21	10	1.60	−1.90	New London, Conn	4.47	Patten, Me	0.00
New Jersey	61.5	−4.3	2 stations	87	20†	Culvers Lake	25	11	2.74	−1.23	Tuckerton	6.13	Newton	0.47
New Mexico	64.8	+0.4	Artesia	103	7	2 stations	21	27	1.45	−0.08	Raton (near)	4.93	Carrizozo	T.
New York	58.0	−3.3	Oneonta	88	15	Indian Lake	22	23	2.04	−1.16	Harkness	4.96	Mohonk Lake	0.64
North Carolina	67.1	−3.4	2 stations	96	2	Jefferson	30	13	6.96	+3.12	Goldsboro	15.66	Altapass	1.44
North Dakota	56.4	0.0	Dickinson	97	23	Cando	16	10	1.10	−0.54	Forman	3.79	Bierman	0.05
Ohio	61.9	−4.0	Hamilton	93	2	Millport	28	25	1.86	−0.95	Fernbank	6.33	Ohio State Univ	0.31
Oklahoma	73.0	−1.1	Lawton	105	7	2 stations	36	27	1.93	−1.06	Blackwell	5.51	Fredrick	0.36
Oregon	61.3	+2.6	Gold Hill	100	16	2 stations	19	22†	1.46	+0.13	Headworks	5.40	Andrews	0.01
Pennsylvania	59.0	−4.4	3 stations	91	1†	Ebensburg	25	11	2.31	−1.16	Bloserville	6.34	Honesdale	0.00
Porto Rico	78.6	−0.2	Canovanas	102	3	Aibonito	57	24†	7.81	−0.29	Jajome Alto	27.71	Cangrejo	2.68
South Carolina	71.2	−2.9	Anderson	98	8	3 stations	40	12†	5.75	+1.76	Rimini	9.76	Charleston	2.34
South Dakota	60.4	−0.6	2 stations	98	2†	Redig	24	20	1.61	+0.31	La Delle	4.56	Ellingson	T.
Tennessee	69.0	−2.0	Savannah	96	5	Erasmus	34	12	2.88	−0.41	Tullahoma	6.71	Kenton	0.13
Texas	76.8	−0.4	Miami	105	7	Lieb (near)	34	27	1.99	−0.85	Orange	6.40	Fowlerton	T.
Utah	61.1	+1.2	St. George	103	7†	2 stations	20	14†	1.08	−0.04	Blacks Fork	2.47	2 stations	0.00
Virginia	64.1	−4.0	Dale Enterprise	96	2	Burks Garden	27	12†	3.12	−0.31	Ivor	6.26	Lexington	1.17
Washington	59.9	+1.7	4 stations	95	17	2 stations	24	29	1.40	−0.34	Queets River	6.53	Wahluke	0.06
West Virginia	62.4	−3.7	Moorefield	98	2	Bayard	23	11	2.79	−0.21	Kayford	6.62	Grafton	1.16
Wisconsin	57.5	−2.4	Beloit	90	1	Prentice	20	10	2.89	−0.79	Rest Lake	5.36	Florence	0.63
Wyoming	55.1	+1.4	Fort Laramie	98	8	Sand Lake	12	26	0.95	−0.48	Bechler River	4.05	Verona	0.00

† Other dates also.

DESCRIPTION OF TABLES AND CHARTS.

(See MONTHLY WEATHER REVIEW, July, 1917, p. 388.)

TABLE I.—*Climatological data for Weather Bureau Stations, September, 1917.*

Districts and stations.	Elevation of instruments.			Pressure.			Temperature of the air.										Mean wet thermometer.	Mean temperature of the dew point.	Mean relative humidity.	Precipitation.			Wind.						Clear days.	Partly cloudy days.	Cloudy days.	Average cloudiness, tenths.	Total snowfall.	Snow on ground at end of month.
	Barometer above sealevel.	Thermometer above ground.	Anemometer above ground.	Station, reduced to mean of 24 hours.	Sealevel, reduced to mean of 24 hours.	Departure from normal.	Mean max.+mean min.÷2.	Departure from normal.	Maximum.	Date.	Mean maximum.	Minimum.	Date.	Mean minimum.	Greatest daily range.				Total.	Departure from normal.	Days with 0.01 inch or more.	Total movement.	Prevailing direction.	Maximum velocity. Miles per hour.	Maximum velocity. Direction.	Maximum velocity. Date.							
	Ft.	*Ft.*	*Ft.*	*In.*	*In.*	*In.*	°*F.*	°*F.*	°*F*		°*F*	°*F.*		°*F*	°*F.*	°*F.*	°*F.*	°*F.*	%	*In.*	*In.*		*Miles*								*0–10*	*In.*	*In.*
New England.							**57.9**	**−2.6**											**79**	**1.84**	**−1.3**										**4.6**		
Eastport	76	67	85	29.99	30.07	+0.04	54.2	−1.0	75	27	62	36	23	46	27	50	47	80	1.51	−1.5	8	5,778	nw.	29	ne.	18	10	13	7	4.5	.....	.....
Greenville	1,070	6	.....	28.92	30.09	.....	53.4	.....	81	27	65	27	23	42	38	.....	.....	.....	1.80	.....	9	.....	.....	.....	.....	.....	15	6	9	.....	.....	.....
Portland, Me	103	82	117	29.99	30.11	+ .06	56.4	−3.2	80	19	65	36	24	48	29	51	47	76	0.32	−2.9	9	5,259	nw.	23	nw.	10	16	9	5	3.9	.....	.....
Concord	288	70	79	29.81	30.12	+ .06	56.1	−3.0	84	19	70	30	24	43	39	.....	.....	.....	0.57	−2.6	6	2,575	n.	20	n.	18	17	10	3	3.0	.....	.....
Burlington	404	11	48	29.68	30.12	+ .06	56.7	−2.2	78	19	67	31	23	47	31	.....	.....	.....	3.62	+0.3	12	5,911	s.	29	s.	6	12	12	6	4.8	.....	.....
Northfield	876	12	60	.....	30.14	+ .08	52.8	−1.8	79	19	67	24	23	39	41	.....	.....	57	1.37	−1.4	9	3,843	s.	20	n.	22	8	14	8	5.9	.....	.....
Boston	125	115	188	29.97	30.11	+ .04	60.2	−2.5	83	19	68	40	24	52	26	55	52	78	1.91	−1.3	7	5,578	sw.	25	sw.	6	16	9	5	3.6	.....	.....
Nantucket	12	14	90	30.08	30.09	+ .01	59.7	−3.1	77	21	66	46	24	53	21	56	54	85	2.37	−0.4	10	10,339	ne.	67	ne.	18	11	9	10	5.6	.....	.....
Block Island	26	11	46	30.07	30.10	+ .02	61.0	−3.1	76	3	67	46	11	55	19	57	55	85	2.80	−0.2	8	10,119	sw.	48	nw.	18	14	6	10	5.2	.....	.....
Narragansett Pier	.....	9	.....	.....	.....	.....	58.5	.....	78	21	68	33	11	49	30	.....	.....	.....	3.81	.....	10	.....	ne.	.....	.....	.....	21	2	7	.....	.....	.....
Providence	160	215	251	29.93	30.10	+ .03	59.8	−3.4	82	19	70	36	24	50	27	54	50	74	2.28	−0.9	9	6,925	nw.	34	n.	10	10	14	6	4.7	.....	.....
Hartford	159	122	140	29.94	30.12	+ .05	59.5	−2.2	81	19	70	36	11	49	31	53	49	75	1.27	−2.2	8	3,689	n.	21	sw.	6	14	6	10	4.9	.....	.....
New Haven	106	117	155	30.01	30.12	+ .05	60.9	−3.0	82	20	71	39	12	51	29	54	49	70	2.23	−1.6	7	5,607	n.	29	sw.	6	13	10	7	4.7	.....	.....
Middle Atlantic States.							**63.1**	**−3.4**											**66**	**2.56**	**−0.8**										**5.2**		
Albany	97	102	115	30.01	30.11	+0.04	60.5	−1.8	82	2	71	36	23	50	32	53	49	75	1.36	−1.8	8	3,956	s.	22	s.	29	15	12	3	3.8	.....	.....
Binghamton	871	10	69	29.20	30.13	+ .06	58.6	−1.4	82	2	70	36	12	47	34	.....	.....	.....	0.94	−1.8	9	2,723	nw.	19	nw.	6	13	14	3	4.5	.....	.....
New York	314	414	454	29.78	30.11	+ .03	63.0	−3.5	83	20	70	43	11	56	22	55	50	69	2.74	−0.8	6	9,229	n.	51	nw.	30	6	13	11	6.1	.....	.....
Harrisburg	374	94	104	29.74	30.14	+ .06	61.9	−3.0	87	2	71	40	11	53	29	55	51	73	4.23	+1.4	10	3,374	n.	30	nw.	2	12	8	10	5.3	.....	.....
Philadelphia	117	123	190	30.00	30.13	+ .05	64.4	−3.0	82	20	72	43	11	57	21	57	53	71	3.27	−0.1	7	6,491	nw.	33	n.	10	9	10	11	5.6	.....	.....
Reading	325	81	98	29.79	30.14	.....	62.4	.....	86	2	72	40	11	53	32	55	51	72	2.42	−1.2	8	3,614	n.	24	nw.	30	10	9	11	5.2	.....	.....
Scranton	805	111	119	29.28	30.14	+ .07	59.4	−2.8	82	2	71	36	11	48	35	53	49	78	0.91	−2.0	7	3,632	ne.	22	n.	10	12	12	6	5.0	.....	.....
Atlantic City	52	37	48	30.06	30.11	+ .04	63.1	−4.5	83	21	69	44	11	57	25	59	56	78	2.70	−0.4	7	5,788	ne.	28	ne.	16	9	11	10	5.3	.....	.....
Cape May	18	13	49	30.12	30.14	+ .07	63.6	−5.4	81	21	70	42	11	57	20	59	.....	.....	2.06	−0.9	7	5,800	n.	32	e.	16	13	10	7	4.6	.....	.....
Sandy Hook	22	10	57	30.09	30.11	.....	63.6	.....	80	20	70	49	11	58	20	58	54	76	2.25	.....	6	10,469	ne.	43	w.	30	9	13	8	5.0	.....	.....
Trenton	190	159	183	29.91	30.11	.....	62.0	.....	81	19	71	40	11	53	28	55	51	74	3.89	.....	8	7,050	ne.	34	n.	10	11	9	10	.....	.....	.....
Baltimore	123	100	113	29.99	30.12	+ .04	64.5	−4.1	83	20	72	43	11	57	24	58	53	70	2.86	−1.0	10	4,785	n.	24	ne.	16	10	11	9	5.2	.....	.....
Washington	112	62	85	30.00	30.12	+ .04	63.8	−4.3	87	2	73	40	11	55	32	57	54	78	1.34	−2.2	9	3,961	n.	29	nw.	30	10	11	9	5.2	.....	.....
Lynchburg	681	153	188	29.38	30.13	+ .05	64.9	−3.5	93	2	75	39	12	55	35	58	55	79	1.96	−1.7	13	4,366	ne.	37	n.	3	10	13	7	5.6	.....	.....
Norfolk	91	170	205	30.00	30.10	+ .04	68.2	−3.5	90	2	74	53	11	62	22	62	59	78	5.26	+1.2	10	9,431	ne.	43	nw.	6	10	8	12	5.9	.....	.....
Richmond	144	11	52	29.97	30.12	+ .05	65.2	−5.6	89	2	74	42	11	57	31	60	57	82	4.62	+1.2	12	4,937	ne.	32	nw.	6	9	8	13	5.7	.....	.....
Wytheville	2,293	49	55	27.76	30.12	+ .05	61.7	−1.9	83	7	72	35	13	51	35	56	54	84	1.80	−1.5	9	3,263	e.	19	nw.	30	10	8	12	5.6	.....	.....
South Atlantic States.							**70.8**	**−2.3**											**82**	**5.99**	**+0.4**										**6.1**		
Asheville	2,255	70	84	27.79	30.12	+0.05	63.8	−1.2	85	7	73	39	13	55	31	58	55	82	4.42	+1.4	10	4,375	se.	30	e.	16	6	15	9	6.0	.....	.....
Charlotte	773	153	161	29.26	30.10	+ .03	67.6	−3.1	89	2	75	45	12	60	25	61	58	78	3.29	+0.1	7	7,410	ne.	32	nw.	2	7	9	14	6.5	.....	.....
Hatteras	11	12	50	30.04	30.05	− .01	71.4	−3.3	87	3	76	58	19	67	17	68	66	85	14.19	+8.9	11	10,270	ne.	44	ne.	16	5	13	12	6.6	.....	.....
Manteo	12	5	43	.....	.....	.....	69.5	.....	91	8	76	50	18	63	.....	.....	.....	.....	10.83	+5.5	7	.....	n.	.....	.....	.....	12	3	15	.....	.....	.....
Raleigh	376	103	110	29.69	30.09	+ .02	67.0	−3.6	91	2	75	46	12	59	27	62	59	80	5.05	+1.7	10	5,713	ne.	28	ne.	16	8	8	14	6.0	.....	.....
Wilmington	78	81	91	29.98	30.06	+ .01	70.4	−2.7	90	2	78	51	12	63	23	65	63	85	9.28	+4.0	12	5,710	ne.	30	ne.	14	6	14	10	6.0	.....	.....
Charleston	48	11	92	29.99	30.04	.00	73.4	−2.8	93	9	79	58	12	67	20	68	66	83	2.34	−3.1	13	8,597	ne.	34	ne.	10	9	11	10	5.6	.....	.....
Columbia, S. C	351	41	57	29.70	30.08	+ .03	71.5	−2.2	92	7	79	50	12	64	32	63	60	75	3.07	−0.4	11	5,128	ne.	24	ne.	9	10	7	13	6.0	.....	.....
Augusta	180	62	77	29.86	30.05	.00	72.5	−1.9	94	9	81	51	12	64	32	66	63	79	8.22	+4.5	8	4,249	ne.	30	nw.	2	9	9	12	5.7	.....	.....
Savannah	65	150	194	29.96	30.03	.00	74.4	−1.0	95	9	81	54	12	67	23	69	67	86	1.77	−3.8	9	7,733	ne.	46	ne.	4	6	10	14	6.5	.....	.....
Jacksonville	43	200	245	29.94	30.00	.00	75.9	−1.4	93	3	82	61	12	70	22	71	70	87	3.47	−4.6	16	9,591	ne.	44	n.	10	9	9	12	6.2	.....	.....
Florida Peninsula.							**80.1**	**−0.6**											**80**	**10.76**	**+2.8**										**6.1**		
Key West	22	10	64	29.90	29.92	−0.02	81.6	−0.9	89	6	87	73	1	77	14	76	74	78	8.37	+1.6	14	6,751	e.	38	se.	26	9	12	9	5.7	.....	.....
Miami	25	71	79	29.93	29.96	.....	79.2	−2.3	88	11	84	70	11	74	18	75	73	82	18.55	+8.9	26	5,467	e.	29	e.	25	5	14	11	6.1	.....	.....
Sand Key	23	39	72	29.88	29.91	− .03	80.9	.....	89	23	84	71	9	77	14	76	74	76	10.39	.....	14	9,344	e.	60	se.	26	11	6	13	5.6	.....	.....
Tampa	35	79	92	29.93	29.96	− .01	79.6	+1.3	95	5	87	68	13	72	20	73	71	83	5.37	−2.0	20	4,606	ne.	24	sw.	29	2	15	13	6.9	.....	.....
East Gulf States.							**73.8**	**−1.1**											**77**	**4.87**	**+1.5**										**5.3**		
Atlanta	1,174	190	216	28.85	30.08	+0.03	70.0	−2.1	91	7	78	50	12	62	22	62	59	75	6.44	+2.9	15	6,322	ne.	30	nw.	30	10	7	13	5.6	.....	.....
Macon	370	78	87	29.66	30.06	+ .03	72.4	−0.5	94	9	81	51	12	64	32	65	62	77	4.99	+1.6	11	4,533	ne.	22	nw.	30	7	7	16	6.3	.....	.....
Thomasville	273	49	58	29.71	30.00	− .01	75.2	−2.6	95	9	84	58	13	67	25	68	65	79	2.15	−2.1	10	3,452	ne.	17	ne.	13	8	8	14	6.3	.....	.....
Pensacola	56	149	185	29.91	29.97	− .02	75.4	−2.5	91	4	82	59	13	69	20	69	66	78	10.23	+5.0	8	10,376	ne.	103	se.	28	12	5	13	5.5	.....	.....
Anniston	741	9	57	29.29	30.08	+ .05	71.0	−0.3	92	8	81	45	30	61	34	.....	.....	.....	4.83	+1.3	10	3,672	e.	27	e.	29	15	9	6	4.2	.....	.....
Birmingham	700	11	48	29.32	30.07	+ .04	72.6	−1.4	91	8	82	53	13	63	27	64	61	77	6.01	+2.5	10	3,986	e.	23	e.	1	13	10	7	4.5	.....	.....
Mobile	57	125	161	29.93	29.99	− .01	76.8	+0.3	93	3	85	58	13	69	23	69	66	78	6.90	+1.9	9	7,434	ne.	98	n.	28	9	12	9	5.4	.....	.....
Montgomery	223	100	112	29.78	30.03	+ .01	73.8	−2.0	93	8	82	52	13	65	30	66	62	72	12.00	+9.1	7	4,780	ne.	39	ne.	29	13	5	12	5.1	.....	.....
Corinth	469	6	.....	.....	.....	.....	71.4	.....	93	5	83	46	12	60	36	.....	.....	.....	2.12	.....	9	.....	ne.	.....	.....	.....	12	17	1	.....	.....	.....
Jackson	304	5	.....	.....	.....	.....	74.8	.....	98	8	86	53	14	63	31	.....	.....	.....	0.44	.....	5	.....	ne.	.....	.....	.....	13	15	2	.....	.....	.....
Meridian	375	85	93	29.64	30.03	+ .01	72.8	+0.1	93	9	82	50	13	64	28	65	62	76	2.25	−1.2	7	3,853	ne.	18	n.	29	11	13	6	4.7	.....	.....
Vicksburg	247	65	74	29.78	30.06	+ .04	73.6	−1.2	91	9	82	55	12	65	27	66	63	79	0.50	−2.8	8	3,908	e.	20	se.	16	11	11	8	4.8	.....	.....
New Orleans	51	76	84	29.93	29.98	.00	78.2	+0.2	92	9	85	65	25	71	17	70	67	76	2.69	−2.1	6	5,234	ne.	30	ne.	28	8	15	7	5.5	.....	.....
West Gulf States.							**76.0**	**+0.2**											**73**	**2.44**	**−1.2**										**5.3**		
Shreveport	249	77	93	29.78	30.05	+0.05	74.1	−1.6	92	8	84	53	29	65	32	66	63	77	2.56	−0.7	4	3,779	ne.	30	se.	1	19	7	4	3.4	.....	.....
Bentonville	1,303	11	44	28.73	30.08	+ .06	68.4	−0.5	90	7	80	40	28	57	35	.....	.....	.....	3.89	+0.4	7	2,870	s.	16	s.	25	21	4	5	3.1	.....	.....
Fort Smith	457	79	94	29.58	30.05	+ .04	73.2	+0.5	94	7	84	49	28	62	35	64	61	73	1.34	−1.8	8	4,209	e.	45	w.	26	10	15	5	4.3	.....	.....
Little Rock	357	139	147	29.69	30.06	+ .03	72.5	−0.6	92	1	82	52	12	63	30	64	61	72	0.27	−3.0	6	4,986	e.	27	ne.	3	13	10	7	4.1	.....	.....
Brownsville	57	4	26	.....	.....	.....	78.8	.....	96	6	89	54	29	69	29	.....	.....	.....	1.03	.....	8	.....	ne.	.....	.....	.....	.....	.....	.....	.....	.....	.....
Corpus Christi	20	69	77	29.97	29.99	+ .04	80.4	+1.4	91	9	86	63	28	75	25	73	70	76	0.82	−3.2	6	7,616	se.	27	se.	5	11	12	7	4.7	.....	.....
Dallas	512	109	117	29.50	30.04	.....	75.9	.....	96	9	86	49	28	66	35	.....	.....	.....	1.90	.....	6	5,112	se.	25	n.	8	12	15	3	4.1	.....	.....
Fort Worth	670	106	114	29.31	30.02	+ .03	75.8	−0.9	94	9	86	53	28	66	34	66	61	70	2.41	−0.5	6	5,560	se.	52	n.	26	17	10	3	3.4	.....	.....
Galveston	54	106	114	29.95	30.01	+ .03	79.4	0.0	92	10	84	67	28	74	17	71	68	73	3.60	−1.8	8	6,710	se.	28	n.	27	20	5	5	3.0	.....	.....
Houston	138	111	121	29.87	30.01	.....	78.9	+0.4	95	8	87	59	29	69	31	.....	.....	.....	1.95	.....	5	4,570	se.	25	se.	1	19	7	4	3.3	.....	.....
Palestine	510	64	72	29.50	30.03	+ .04	76.3	+1.6	96	1	86	57	28	66	30	67	64	77	2.35	−0.8	6	4,136	ne.	27	se.	3	12	14	4	4.0	.....	.....
Port Arthur	34	58	66	29.95	29.99	.....	77.2	.....	92	21	86	57	29	69	28	70	68	82	2.65	.....	7	5,696	e.	29	n.	10	17	10	3	3.1	.....	.....
San Antonio	701	119	132	29.28	29.99	+ .03	79.3	+2.2	96	10	90	55	28	69	34	67	62	66	1.39	−1.6	6	4,844	n.	25	n.	10	22	6	2	2.4	.....	.....
Taylor	582	55	63	29.43	30.04	+ .07	77.2	+0.3	94	8	88	54	29	66	33	.....	.....	.....	3.87	+0.8	7	4,585	ne.	34	se.	5	16	8	6	3.7	.....	.....

TABLE I.—*Climatological data for Weather Bureau Stations, September, 1917*—Continued.

Districts and stations	Elevation of instruments.			Pressure.			Temperature of the air.									Mean wet thermometer.	Mean temperature of the dew point.	Mean relative humidity.	Precipitation.			Wind.						Clear days.	Partly cloudy days.	Cloudy days.	Average cloudiness, tenths.	Total snowfall.	Snow on ground at end of month.
	Barometer above sea level.	Thermometer above ground.	Anemometer above ground.	Station, reduced to mean of 24 hours.	Sea level, reduced to mean of 24 hours.	Departure from normal.	Mean max.+mean min.÷2.	Departure from normal.	Maximum.	Date.	Mean maximum.	Minimum.	Date.	Mean minimum.	Greatest daily range.				Total.	Departure from normal.	Days with 0.01 inch or more.	Total movement.	Prevailing direction.	Maximum velocity. Miles per hour.	Maximum velocity. Direction.	Maximum velocity. Date.						
Ohio Valley and Tennessee.	*Ft.*	*Ft.*	*Ft.*	*In.*	*In.*	*In.*	°F.	°F.	°F		°F	°F.		°F	°F.	°F.	°F.	%	*In.*	*In.*		*Miles*								*0–10*	*In.*	*In.*
							66.5	**−1.5**										**75**	**2.30**	**−0.5**										**4.0**		
Chattanooga	762	189	213	29.28	30.09	+0.03	69.8	−1.4	89	6	78	51	12	61	25	62	59	76	4.16	+0.9	11	4,122	ne.	26	n.	10	10	12	8	5.1	.....	.....
Knoxville	99	102	111	29.04	30.09	+ .03	68.8	−0.6	88	7	78	48	11	59	28	62	59	76	3.13	+0.3	6	3,488	ne.	24	n.	10	12	10	8	4.8	.....	.....
Memphis	399	76	97	29.68	30.10	+ .07	72.2	−0.6	90	5	81	50	11	64	29	65	62	77	1.88	−1.2	4	4,399	n.	20	e.	1	17	8	5	3.7	.....	.....
Nashville	549	168	191	29.51	30.10	+ .04	70.3	−1.2	90	6	80	46	12	60	30	63	60	77	1.51	−2.2	5	4,551	ne.	39	e.	16	11	13	6	4.8	.....	.....
Lexington	980	193	230	29.05	30.11	+ .04	67.2	−0.7	86	1	76	42	11	58	25	.....	.....	.....	2.46	0.0	5	7,681	sw.	40	sw.	7	17	7	6	3.4	.....	.....
Louisville	525	219	255	29.54	30.12	+ .08	68.8	−1.1	90	2	79	44	11	58	31	60	55	69	2.27	−0.4	7	6,499	n.	58	se.	7	18	7	5	3.3	.....	.....
Evansville	431	139	175	29.63	30.09	+ .03	70.4	+0.7	92	1	81	44	11	60	26	61	56	70	3.35	+0.7	6	6,113	ne.	40	nw.	3	15	12	3	3.6	.....	.....
Indianapolis	822	194	230	29.24	30.12	+ .06	65.2	−2.5	87	2	76	39	11	55	30	57	52	70	2.93	−0.1	7	7,068	ne.	31	nw.	29	17	5	8	3.6	.....	.....
Terre Haute	575	93	129	29.48	30.09	.....	65.8	.....	91	2	77	39	11	55	32	58	54	71	0.77	.....	2	5,736	ne.	28	nw.	30	12	14	4	4.3	.....	.....
Cincinnati	628	11	51	29.44	30.12	+ .05	64.9	+0.2	89	2	76	40	11	54	36	57	53	74	2.97	+0.7	7	3,907	ne.	22	ne.	10	16	9	5	3.3	.....	.....
Columbus	824	173	222	29.25	30.12	+ .05	63.8	−2.1	86	2	74	39	11	53	30	56	53	74	0.55	−2.0	6	6,602	ne.	36	nw.	30	17	10	3	3.3	.....	.....
Dayton	899	181	210	29.15	30.10	.....	63.8	−3.6	86	2	74	40	11	53	31	57	53	74	0.85	−1.6	6	5,413	ne.	28	nw.	30	19	4	7	3.8	.....	.....
Pittsburgh	842	353	410	29.23	30.14	+ .06	62.1	−4.0	84	2	72	38	11	52	30	55	52	76	1.90	−0.6	7	6,169	nw.	58	n.	6	12	12	6	4.1	.....	.....
Elkins	1,940	41	50	28.10	30.15	+ .07	60.1	−1.8	83	2	73	34	12	47	41	53	51	87	2.83	0.0	9	2,105	w.	17	w.	30	11	9	10	5.0	.....	.....
Parkersburg	638	77	84	29.48	30.14	+ .06	64.0	−2.1	87	2	75	40	12	53	33	57	54	81	1.41	−1.3	7	2,912	n.	24	nw.	6	12	12	6	4.4	.....	.....
Lower Lake Region.							**60.2**	**−2.9**										**74**	**1.88**	**−0.9**										**6.7**		
Buffalo	767	247	280	29.29	30.12	+0.06	59.4	−3.5	76	14	66	41	10	53	27	54	50	74	2.29	−0.9	8	9,730	sw.	54	sw.	29	9	12	9	5.2	.....	.....
Canton	448	10	61	29.63	30.10	.....	56.6	−2.7	78	27	67	35	10	46	32	.....	.....	.....	2.02	−0.8	8	5,291	sw.	29	sw.	12	13	11	6	4.3	.....	.....
Oswego	325	76	91	29.74	30.11	+ .05	58.9	−3.8	81	1	66	40	23	52	27	53	49	75	1.72	−1.1	11	6,003	s.	30	ne.	9	9	15	6	4.7	.....	.....
Rochester	523	97	113	29.57	30.14	+ .08	59.6	−2.3	81	1	69	40	23	50	29	53	49	73	1.52	−0.8	10	5,047	sw.	24	w.	30	11	13	6	4.6	.....	.....
Syracuse	397	97	113	29.49	30.14	+ .07	59.2	−2.4	79	1	68	40	23	50	28	53	49	74	1.50	−1.3	9	6,115	s.	29	w.	6	9	18	3	4.7	.....	.....
Erie	714	130	166	29.35	30.13	+ .07	60.8	−3.1	79	1	68	46	23	54	25	55	51	74	1.51	−2.0	10	8,188	se.	42	sw.	29	12	14	4	4.0	.....	.....
Cleveland	762	190	201	29.31	30.14	+ .08	60.5	−3.8	80	1	67	45	11	54	24	55	51	75	2.74	−0.5	9	8,744	ne.	42	nw.	30	18	7	5	3.5	.....	.....
Sandusky	629	62	103	29.45	30.14	+ .08	62.0	−3.3	84	1	70	41	11	54	27	56	52	75	2.34	−0.3	6	7,318	ne.	31	nw.	5	12	13	5	4.2	.....	.....
Toledo	628	208	243	29.46	30.15	+ .09	62.2	−1.9	84	1	71	40	11	53	27	56	52	75	1.27	−1.1	6	8,062	ne.	44	sw.	29	19	7	4	3.2	.....	.....
Fort Wayne	856	113	124	29.22	30.15	.....	62.0	−3.5	84	1	73	39	11	51	30	54	50	71	0.60	.....	5	5,049	ne.	33	nw.	29	18	10	2	3.2	.....	.....
Detroit	730	218	245	29.35	30.14	+ .09	61.2	−1.9	80	14	70	39	11	52	26	54	50	75	1.84	−0.6	7	6,953	e.	38	nw.	29	18	6	6	3.6	.....	.....
Upper Lake Region.							**57.4**	**−1.7**										**80**	**2.32**	**−0.9**										**5.0**		
Alpena	609	13	92	29.47	30.14	+0.11	54.8	−2.5	78	19	64	36	23	45	30	51	48	83	1.38	−2.1	7	6,473	nw.	37	s.	5	13	11	6	4.2	.....	.....
Escanaba	612	54	60	29.46	30.12	+ .11	54.6	−2.3	74	1	62	37	10	47	29	51	49	83	1.39	−2.2	8	6,342	s.	28	n.	9	12	9	9	4.9	.....	.....
Grand Haven	632	54	92	29.44	30.12	+ .08	58.6	−2.5	83	15	67	35	10	50	28	53	50	78	2.74	−0.4	8	6,256	nw.	31	s.	5	15	9	6	4.1	.....	.....
Grand Rapids	707	70	87	29.37	30.14	+ .09	60.3	−1.5	82	15	70	36	10	50	29	54	50	75	3.59	+0.5	7	3,311	e.	27	w.	29	14	7	9	4.4	.....	.....
Houghton	684	62	99	29.36	30.09	+ .09	55.5	−0.6	81	24	63	36	10	48	29	.....	.....	.....	2.46	−1.1	11	6,398	e.	42	w.	5	7	10	13	6.3	.....	.....
Lansing	878	11	62	29.19	30.14	.....	58.6	−2.7	82	1	71	33	10	46	33	52	50	87	4.60	+2.0	9	3,007	sw.	20	nw.	30	14	8	8	4.4	.....	.....
Ludington	637	60	66	29.44	30.14	.....	56.7	.....	80	15	64	40	10	49	25	53	50	80	1.80	.....	8	6,055	s.	31	s.	5	13	8	9	4.3	.....	.....
Marquette	734	77	111	29.33	30.14	+ .14	55.8	−1.0	82	18	63	40	9	49	27	50	47	78	2.10	−1.4	11	6,790	w.	36	se.	5	4	13	13	6.6	.....	.....
Port Huron	638	70	120	29.44	30.13	+ .07	58.6	−2.3	81	1	68	35	11	49	30	53	50	78	1.63	−1.0	8	6,700	ne.	30	nw.	30	12	15	3	4.2	.....	.....
Saginaw	641	48	82	29.44	30.14	.....	58.8	.....	82	1	70	35	11	48	31	52	49	79	0.84	−2.3	8	5,048	s.	28	s.	5	13	6	11	5.1	.....	.....
Sault Sainte Marie	614	11	61	29.44	30.14	+ .12	53.4	−0.9	76	15	62	35	11	45	32	50	48	87	1.39	−2.1	11	5,261	nw.	34	nw.	5	8	10	12	6.0	.....	.....
Chicago	823	140	310	29.24	30.13	+ .09	63.7	−0.9	86	1	70	45	11	58	23	56	51	68	2.15	−0.9	7	7,982	ne.	32	sw.	5	15	8	7	4.3	.....	.....
Green Bay	617	109	144	29.45	30.11	+ .09	58.2	−0.9	80	17	67	36	10	49	32	52	49	78	1.95	−1.2	11	6,930	s.	35	nw.	29	9	9	12	6.2	.....	.....
Milwaukee	681	119	133	29.38	30.12	+ .09	60.4	−1.1	80	5	67	40	10	54	24	54	50	75	4.08	+1.2	10	6,505	se.	37	e.	7	14	9	7	4.4	.....	.....
Duluth	1,133	11	47	28.88	30.11	+ .13	53.6	−3.1	78	17	62	31	10	46	28	49	47	84	2.15	−1.4	11	7,968	ne.	36	w.	5	12	8	10	5.2	.....	.....
North Dakota.							**56.9**	**−0.8**										**72**	**1.12**	**−0.3**										**5.0**		
Moorhead	940	8	57	29.07	30.09	+0.13	57.8	−1.2	89	23	70	27	10	46	40	51	49	83	1.16	−1.1	10	5,073	se.	28	nw.	29	11	12	7	4.6	.....	.....
Bismarck	1,674	8	57	28.31	30.09	+ .15	57.6	+0.5	90	23	70	31	30	45	41	50	44	69	1.75	+0.6	5	6,743	e.	40	nw.	28	12	9	9	5.1	.....	.....
Devils Lake	1,482	11	44	28.47	30.05	+ .11	55.9	+0.3	89	23	68	24	10	43	40	48	43	71	0.83	−0.6	8	6,832	se.	37	nw.	4	9	7	14	5.8	.....	.....
Grand Forks	835	12	89	.....	.....	.....	64.4	.....	98	17	79	36	29	50	44	57	.....	.....	1.58	.....	7	.....	s.	39	se.	4	23	4	4	.....	.....	.....
Williston	1,872	41	48	28.04	30.02	+ .09	56.5	−3.0	92	22	70	27	30	43	49	48	41	63	0.72	−0.2	4	5,802	se.	44	nw.	4	12	10	8	4.5	.....	.....
Upper Mississippi Valley.							**63.5**	**−1.2**										**77**	**2.77**	**−0.5**										**4.5**		
Minneapolis	918	10	208	29.10	30.08	.....	60.0	−0.3	84	16	69	37	10	51	28	.....	.....	.....	2.16	−1.5	9	7,360	s.	38	nw.	29	10	9	11	5.6	.....	.....
St. Paul	837	201	236	29.18	30.08	+0.09	59.4	−2.3	84	16	69	35	11	50	34	.....	.....	.....	2.00	−1.4	8	7,111	s.	39	nw.	29	12	9	9	5.1	.....	.....
La Crosse	714	11	48	29.33	30.11	+ .10	59.0	−2.1	83	16	69	34	10	49	30	.....	.....	.....	3.36	−0.8	6	2,637	s.	16	sw.	25	12	9	9	4.9	.....	.....
Madison	974	70	78	29.08	30.13	+ .10	60.0	−1.1	81	15	69	38	10	51	23	54	50	76	2.98	−0.2	8	5,518	s.	26	ne.	9	10	10	10	5.2	.....	.....
Wausau	1,247	4	.....	28.79	30.12	.....	56.0	.....	80	17	69	29	10	45	35	.....	.....	.....	2.81	.....	9	.....	se.	.....	.....	.....	14	6	10	4.6	.....	.....
Charles City	1,015	10	49	29.03	30.11	+ .11	60.0	−1.7	85	15	70	33	11	50	32	54	51	80	2.75	0.0	9	3,707	se.	24	se.	3	13	9	8	5.3	.....	.....
Davenport	606	71	79	29.45	30.11	+ .08	63.7	−1.0	87	5	73	42	11	54	29	56	53	77	6.27	+3.1	11	4,337	e.	31	e.	3	11	6	13	5.1	.....	.....
Des Moines	881	84	97	29.17	30.08	+ .06	64.0	−1.0	90	5	73	41	11	55	29	57	53	75	1.99	−1.1	11	4,398	se.	27	s.	25	12	6	12	5.2	.....	.....
Dubuque	698	81	96	29.38	30.13	+ .10	61.8	−1.8	86	5	71	36	11	52	30	54	51	75	2.40	−1.2	8	3,601	s.	27	s.	3	15	4	11	4.5	.....	.....
Keokuk	614	64	78	29.43	30.10	+ .07	65.6	−0.8	90	1	75	41	11	56	28	58	55	75	5.29	.....	8	4,308	ne.	26	n.	3	14	9	7	3.9	.....	.....
Cairo	356	87	93	29.70	30.07	+ .02	70.6	+0.4	90	1	80	45	11	61	28	63	60	78	1.40	−1.1	4	4,684	n.	43	n.	3	15	13	2	3.7	.....	.....
Peoria	609	11	45	29.45	30.12	+ .08	63.7	−0.6	86	1	75	35	11	53	33	57	54	82	3.14	0.0	7	3,662	s.	21	sw.	5	15	10	5	3.5	.....	.....
Springfield, Ill.	644	10	91	29.41	30.08	+ .03	65.2	−1.2	87	2	76	39	11	54	30	58	54	76	1.61	−1.8	6	4,908	s.	27	e.	3	14	8	8	4.1	.....	.....
Hannibal	534	74	109	29.52	30.09	+ .06	66.4	−1.5	91	7	77	40	11	56	32	.....	.....	.....	2.43	−1.1	8	5,012	sw.	44	w.	7	17	9	4	3.6	.....	.....
St. Louis	567	265	303	29.48	30.08	+ .04	69.0	−1.0	91	2	78	43	11	60	24	61	57	72	3.50	+0.6	8	7,575	s.	38	ne.	3	16	9	5	3.8	.....	.....
Missouri Valley.							**65.6**	**0+.1**										**72**	**2.51**	**−0.1**										**4.4**		
Columbia, Mo.	781	11	84	29.26	30.09	+0.06	67.5	−0.3	92	7	79	42	22	56	34	.....	.....	.....	2.38	−0.5	6	4,391	se.	23	n.	7	17	8	5	3.7	.....	.....
Kansas City	963	161	181	29.04	30.07	+ .05	68.8	+1.3	92	7	78	46	27	60	27	60	55	67	3.33	−0.4	7	7,039	s.	32	nw.	7	18	5	7	3.4	.....	.....
St. Joseph	967	11	49	29.04	30.07	.....	67.8	.....	91	3	78	44	27	58	23	59	56	73	1.60	.....	3	4,726	se.	21	nw.	19	17	8	5	3.4	.....	.....
Springfield, Mo.	1,324	98	104	28.70	30.09	+ .06	68.0	+0.1	88	3	77	46	11	59	26	60	56	73	3.74	0.0	3	5,687	s.	24	s.	7	20	5	5	3.2	.....	.....
Iola	984	11	50	29.04	30.06	+ .05	69.8	−1.2	95	7	82	41	30	58	36	.....	.....	.....	1.85	−1.5	6	3,844	s.	21	ne.	26	21	3	6	2.7	.....	.....
Topeka	983	85	101	.....	.....	.....	68.1	−0.2	95	7	79	42	27	58	33	.....	.....	.....	5.38	+1.8	6	5,640	se.	24	n.	26	15	10	5	3.6	.....	.....
Drexel	1,299	10	54	28.68	30.07	.....	64.6	.....	93	3	76	38	27	54	33	57	54	79	1.51	.....	9	6,334	se.	28	sw.	7	11	13	6	4.6	.....	.....
Lincoln	1,189	11	84	28.81	30.06	+ .07	66.5	+1.3	96	3	78	40	27	55	33	58	54	72	2.31	−0.3	6	6,311	se.	30	s.	7	11	10	9	5.0	.....	.....
Omaha	1,105	115	122	28.90	30.07	+ .07	66.2	+0.4	93	3	76	43	27	56	29	58	53	70	0.91	−2.1	6	5,740	se.	26	n.	3	15	8	7	4.4	.....	.....
Valentine	2,598	47	54	27.36	30.06	+ .10	62.0	−0.3	92	4	75	38	28	49	44	53	48	69	2.23	+0.4	9	6,822	s.	31	se.	23	11	10	9	4.8	.....	.....
Sioux City	1,135	94	164	28.86	30.07	+ .09	63.4	−0.7	84	14	73	40	26	54	33	56	52	73	0.97	−1.5	7	7,550	se.	40	w.	18	11	12	7	4.8	.....	.....
Huron	1,306	59	74	28.69	30.09	+ .13	60.6	+1.0	88	8	72	37	30	49	36	53	49	74	1.87	+0.2	11	7,316	se.	32	nw.	25	6	12	12	6.1	.....	.....
Pierre	1,572	70	75	28.40	30.06	+ .11	62.6	−0.2	92	8	75	37	26	50	46	54	49	69	1.83	+0.7	9	6,790	se.	42	n.	5	13	5	12	4.8	.....	.....
Yankton	1,233	49	57	28.75	30.07	+ .09	63.1	−0.2	84	16	74	38	27	53	38	.....	.....	.....	3.32	+0.9	13	4,895	nw.	27	se.	2	6	11	13	6.4	.....	.....

TABLE I.—*Climatological data for Weather Bureau Stations, September, 1917*—Continued.

Districts and stations.	Elevation of instruments.			Pressure.			Temperature of the air.											Mean wet thermometer.	Mean temperature of the dew point.	Mean relative humidity.	Precipitation.			Wind.					Clear days.	Partly cloudy days.	Cloudy days.	Average cloudiness, tenths.	Total snowfall.	Snow on ground at end of month.
	Barometer above sealevel.	Thermometer above ground.	Anemometer above ground.	Station, reduced to mean of 24 hours.	Sealevel, reduced to mean of 24 hours.	Departure from normal.	Mean max.+mean min.÷2.	Departure from normal.	Maximum.	Date.	Mean maximum.	Minimum.	Date.	Mean minimum.	Greatest daily range.					Total.	Departure from normal.	Days with 0.01 inch or more.	Total movement.	Prevailing direction.	Maximum velocity. Miles per hour.	Maximum velocity. Direction.	Maximum velocity. Date.						
	Ft.	*Ft.*	*Ft.*	*In.*	*In.*	*In.*	°*F.*	°*F.*	°*F*		°*F*	°*F.*		°*F*	°*F.*	°*F.*	°*F.*	%	*In.*	*In.*		*Miles*								*0–10*	*In.*	*In.*
Northern Slope.							**54.8**	**+0.9**										**63**	**1.43**	**+0.3**										**4.3**		
Billings	3,140	5		27.38	30.00	+0.06	58.3		92	4	74	33	25	42	54				1.36		7		sw.				16	10	4			
Havre	2,505	11	44	27.38	30.00	+0.06	56.6	−1.0	87	22	70	33	5	43	44	49	45	72	4.58	+3.6	7	4,350	e.	46	sw.	11	15	8	7	4.4	5.	
Helena	4,110	87	112	25.85	30.00	+.06	57.6	+1.4	84	21	71	35	24	45	40	48	40	59	1.45	+0.4	6	5,626	sw.	38	sw.	13	11	14	5	4.7		
Ka'ispell	2,962	11	34	26.95	29.98	+.02	56.8	+2.9	84	21	71	33	29	43	39	47	40	62	0.83	−0.5	7	2,715	w.	23	sw.	27	15	8	7	4.7		
Miles City	2,371	48	55	27.51	30.05	+.10	61.1	−0.1	93	22	75	38	25	47	47	52	47	68	T.	−0.9	0	4,190	e.	36	w.	11	17	9	4	3.4		
Rapid City	3,259	50	58	26.68	30.07	+.11	60.4	+1.3	88	4	74	37	25	46	41	49	41	56	0.99	−0.3	5	5,550	w.	40	nw.	4	14	11	5	4.1		
Cheyenne	6,088	84	101	24.13	30.02	+.06	58.6	+1.4	85	3	72	35	26	45	36	47	40	58	0.56	−0.4	10	7,639	w.	50	w.	27	9	18	3	4.4		
Lander	5,372	60	68	24.74	30.04	+.08	57.8	+2.6	87	3	75	24	26	41	43	45	35	51	0.05	−1.0	3	3,113	w.	26	w.	4	13	13	4	4.1		
Sheridan	3,790	10	47	26.16	30.04	.....	57.9	.....	89	21	75	31	30	41	51	47	40	63	0.30	.....	6	3,262	nw.	38	sw.	23	10	12	8	4.7		
Yellowstone Park	6,200	11	48	23.98	30.04	+.07	52.7	−0.7	80	3	66	33	1	39	43	43	36	61	1.75	+0.7	9	4,801	s.	32	sw.	13	9	13	8	5.4	0.4	
North Platte	2,821	11	51	27.17	30.08	+.11	63.6	+0.4	93	4	76	37	20	51	40	55	52	76	2.68	+1.2	8	4,730	se.	32	ne.	8	20	4	6	3.5		
Middle Slope.							**68.6**	**+1.0**										**65**	**1.21**	**−0.8**										**3.3**		
Denver	5,292	106	113	24.83	30.02	+0.06	64.8	+2.1	92	3	78	41	26	51	36	51	42	54	0.60	−0.3	6	4,643	se.	36	nw.	1	15	12	3	3.5		
Pueblo	4,685	80	86	25.39	30.03	+.07	65.5	+1.1	93	4	80	38	27	51	41	53	46	61	3.25	+2.6	9	3,841	se.	42	nw.	19	18	7	5	3.4		
Concordia	1,392	50	58	28.60	30.06	+.07	68.4	+0.3	94	3	81	40	27	56	34	59	54	68	0.56	−2.0	6	4,919	se.	24	n.	29	12	14	4	4.6		
Dodge City	2,509	11	51	27.49	30.06	+.08	69.4	+1.2	94	6	81	39	27	58	42	59	55	69	0.36	−1.4	3	6,710	se.	36	n.	29	21	3	6	3.0		
Wichita	1,358	139	158	28.62	30.04	+.04	70.4	+0.6	93	7	81	42	27	60	33	61	56	68	0.92	−2.2	7	8,149	s.	36	s.	2	22	3	5	2.6		
Altus	1,410	5					76.4	.....	102	8	91	44	27	62	46				1.11	.....	6		se.				20	6	4			
Muskogee	652	4					72.4	.....	94	7	86	43	28	59	44				1.53	.....	4		s.				17	2	11			
Oklahoma	1,214	10	47	28.78	30.04	+.10	73.3	+1.2	98	7	86	45	27	61	36	62	58	71	1.55	−1.2	6	7,543	s.	33	n.	26	16	8	6	3.5		
Southern Slope.							**73.7**	**+1.0**										**49**	**1.41**	**−1.2**										**3.9**		
Abilene	1,738	10	52	28.23	30.00	+0.04	76.2	+2.0	98	7	88	46	28	64	39	63	56	60	1.48	−1.7	7	5,684	s.	31	sw.	26	13	10	7	4.2		
Amarillo	3,676	10	49	26.36	30.04	+.08	69.4	+1.7	94	7	81	40	27	58	41	59	55	71	2.05	−0.3	9	6,428	se.	35	n.	10	19	5	6	3.8		
Del Rio	944	64	71	29.00	29.98	+.04	78.8	−0.1	95	10	88	55	28	70	34	.....	.....	.....	0.99	−1.5	8	5,751	e.	36	ne.	3	13	13	4	4.0		
Roswell	3,566	75	85	26.42	29.98	+.06	70.6	+0.3	96	7	84	41	27	58	48	59	52	64	1.11	−1.2	6	4,594	s.	30	ne.	26	14	11	5	3.5		
Southern Plateau.							**72.0**	**+1.5**										**48**	**0.40**	**−0.5**										**3.2**		
El Paso	3,762	110	133	26.22	29.91	+0.03	73.8	+1.1	94	7	84	51	27	63	34	60	51	52	0.76	−0.7	8	6,446	e.	34	e.	9	20	6	4	3.1		
Santa Fe	7,013	57	66	23.38	29.95	+.02	62.6	+2.0	84	3	74	36	27	51	34	49	41	55	0.64	−1.0	8	4,745	e.	24	se.	10	6	24	0	4.9		
Flagstaff	6,908	8	57	23.47	29.95	+.06	57.8	+2.3	82	9	73	25	27	42	49	47	.....	.....	1.78	.....	6	.....	sw.	34	w.	23	17	13	0	.....	.....	.....
Phoenix	1,108	11	81	28.70	29.82	+.01	83.2	+1.8	106	4	97	55	27	69	44	67	59	50	0.55	−0.5	4	3,657	e.	32	se.	18	20	9	1	2.5		
Yuma	141	9	54	29.67	29.81	+.03	86.6	+2.7	110	4	101	57	25	72	39	68	58	48	0.17	0.0	1	3,244	sw.	24	e.	20	22	6	2	2.4		
Independence	3,910	11	42	.....	29.92	+0.06	68.3	−0.8	94	14	87	43	23	50	46	.....	.....	34	T.	−0.1	0	.....	nw.	.....	.....	.....	27	3	0	.....	.....	.....
Needles	488	4	....	29.31	29.80	.....	84.4	.....	112	4	101	51	29	68	47	.....	.....	.....	0.37	.....	4	.....	w.	.....	.....	.....	20	6	4	.....	.....	.....
Middle Plateau.							**63.5**	**+1.1**										**40**	**0.51**	**−0.2**										**2.5**		
Reno	4,532	74	81	25.51	29.96	+0.01	62.6	+2.9	90	18	80	34	25	46	43	47	34	42	T.	−0.3	0	4,798	w.	35	w.	12	25	4	1	1.4		
Tonopah	6,090	12	20	24.14	29.96	.....	64.2	.....	83	1	75	35	23	54	30	47	31	33	0.13	−0.4	2	6,074	se.	36	nw.	22	23	7	0	1.8		
Winnemucca	4,344	18	56	25.65	30.00	+.07	61.4	+0.9	91	1	81	29	25	42	49	46	31	38	T.	−0.3	0	3,983	sw.	27	s.	5	14	13	3	3.0		
Modena	5,479	10	43	24.69	29.98	+.0	60.3	+0.1	88	4	78	31	16	43	48	44	28	39	0.79	−0.3	5	7,196	sw.	44	sw.	13	18	8	4	3.0		
Salt Lake City	4,300	163	203	25.68	29.99	+.04	66.4	+1.3	91	2	78	42	26	55	32	51	40	46	1.16	+0.3	10	5,078	se.	52	w.	4	19	6	5	2.9		
Grand Junction	4,602	82	96	25.46	30.00	+.05	66.7	+0.3	90	4	80	39	26	54	34	51	39	43	1.00	0.0	9	5,342	se.	44	w.	23	20	5	5	3.0		
Northern Plateau.							**64.0**	**+2.8**										**50**	**1.48**	**+0.7**										**3.9**		
Baker	3,471	48	53	26.47	30.02	+0.03	59.4	+2.4	87	18	74	33	14	44	41	49	40	56	2.44	+1.7	4	4,086	se.	18	se.	26	17	8	5	3.7		
Boise	2,739	78	86	27.16	29.98	+.01	66.0	+4.1	94	19	80	38	14	52	40	53	42	47	1.39	+1.0	5	3,240	nw.	22	nw.	13	17	8	5	2.9		
Lewiston	757	40	48	29.18	29.98	.00	66.6	+3.1	98	19	81	44	14	52	40	.....	.....	.....	2.14	+1.5	5	1,566	e.	20	w.	12	12	14	4	3.9		
Pocatello	4,477	60	68	25.52	29.98	+.02	63.0	+2.3	89	3	77	37	15	50	40	49	38	46	1.29	+0.4	6	6,356	se.	36	sw.	13	14	9	7	3.9		
Spokane	1,929	101	110	27.96	29.98	.00	62.2	+3.4	90	19	75	38	29	50	38	51	40	51	0.34	−0.7	4	3,496	sw.	32	w.	12	12	9	4	4.8		
Walla Walla	991	57	65	28.92	29.98	+.02	66.8	+1.4	91	17	78	46	29	56	32	55	45	50	1.31	+0.4	6	2,881	s.	17	sw.	24	16	7	7	4.1		
North Pacific Coast Region.							**59.2**	**+1.6**										**82**	**2.25**	**−0.2**										**6.4**		
North Head	211	11	56	29.82	30.04	+0.01	56.0	−0.2	65	5	59	49	30	53	11	55	55	96	2.33	+0.5	16	10,615	se.	54	se.	6	3	7	20	7.5		
North Yakima	1,071	4					64.2	.....	91	17	79	40	30	49	4				0.34	.....	3	.....	nw.	.....	.....	.....	17	7	6	.....	.....	.....
Port Angeles	53	8	48	30.03	30.06	.....	53.4	.....	71	1	61	40	27	46	24	.....	.....	.....	1.11	−0.7	12	3,184	nw.	34	nw.	26	7	6	17	6.8		
Seattle	125	215	250	29.93	30.06	+.05	58.9	+1.0	75	15	66	46	30	52	25	55	51	79	1.29	−0.6	11	4,813	s.	38	s.	26	8	4	18	6.5		
Tacoma	213	113	120	29.82	30.04	+.02	59.0	+1.4	76	15	67	42	29	51	28	54	51	78	2.01	−0.5	12	3,317	n.	25	w.	12	6	7	17	6.9		
Tatoosh Island	109	7	57	29.94	30.03	+.02	54.8	+1.8	66	15	59	48	10	51	16	53	52	93	6.34	+0.2	15	7,482	s.	48	s.	26	4	8	18	7.1		
Medford	1,425	4					64.6	.....	99	16	82	33	24	47	49				0.30	.....	3	.....	nw.	.....	.....	.....	13	9	8	.....	.....	.....
Portland, Oreg	153	68	106	29.87	30.02	−.01	63.1	+2.5	83	1	72	50	30	55	27	57	54	75	1.93	+0.1	13	3,319	nw.	17	w.	12	7	11	12	5.9		
Roseburg	510	9	57	29.49	30.04	+.02	63.5	+3.0	93	16	76	44	20	51	40	55	50	68	0.73	−0.3	6	1,653	n.	14	n.	17	15	11	'4	4.0		
Middle Pacific Coast Region.							**65.1**	**+1.7**										**51**	**0.36**	**−0.2**										**3.2**		
Eureka	62	73	89	29.99	30.06	+0.05	56.4	+1.5	71	6	62	47	24	51	20	54	52	88	0.66	−0.4	2	3,760	sw.	32	sw.	21	9	9	12	5.9		
Mount Tamalpais	2,375	11	18	27.55	29.99	+.03	66.2	+0.1	93	16	74	45	2	58	26	53	42	49	0.18	−0.4	2	10,254	w.	58	nw.	12	22	6	2	2.5		
Point Reyes Light	490	7	18	29.44	29.96	.....	57.6	+1.5	81	28	63	47	20	52	29	.....	.....	.....	0.13	.....	4	12,443	nw.	60	nw.	13	11	8	11	5.5		
Red Bluff	332	50	56	29.57	29.92	−.01	73.8	−0.1	101	16	88	47	23	60	39	57	43	39	0.80	0.0	2	3,651	se.	31	nw.	24	25	3	2	1.7		
Sacramento	69	106	117	29.86	29.93	+.04	71.4	+2.3	102	17	86	47	23	57	36	59	50	56	0.51	+0.1	2	5,150	s.	24	nw.	14	26	3	1	1.3		
San Francisco	155	209	213	29.80	29.97	+.03	64.0	+4.7	94	15	72	49	20	56	32	57	52	74	0.02	−0.3	1	6,024	sw.	34	sw.	18	19	7	4	3.3		
San Jose	141	12	110	29.84	29.98	.....	66.5	+1.8	98	16	81	44	21	52	46	.....	.....	.....	0.01	−0.3	1	3,651	nw.	23	nw.	21	22	7	1	2.0		
South Pacific Coast Region.							**70.5**	**+3.2**										**62**	**T.**	**−0.2**										**2.0**		
Fresno	327	89	98	29.56	29.91	+0.04	75.4	+1.1	102	17	91	52	24	60	40	58	44	39	T.	−0.3	0	5,374	nw.	30	nw.	21	25	5	0	1.3		
Los Angeles	338	159	191	29.55	29.91	+.03	70.8	+4.3	99	27	82	55	19	60	32	60	54	67	T.	−0.1	0	3,778	sw.	19	sw.	28	24	51	1	1.6		
San Diego	87	62	70	29.81	29.90	+.01	68.2	+1.3	92	28	74	58	26	62	27	62	59	79	T.	−0.1	0	4,273	nw.	27	nw.	28	21	8	1	2.5		
San Luis Obispo	201	32	40	29.75	29.96	+.03	67.8	+6.3	98	27	81	49	17	54	47	57	50	65	T.	−0.4	0	2,865	nw.	24	sw.	10	20	10	0	2.4		
West Indies.																																	
San Juan, P. R	82	8	54	29.88	29.96	+0.02	79.7	.....	91	4	84	71	22	75	17	75	73	80	4.64	−2.2	20	8,303	e.	52	ne.	21	11	12	7	4.9		
Panama Canal.																																	
Balboa Heights	118	7	97	29.74	29.86	.....	79.0	.....	89	22	85	71	10	73	17	75	74	91	11.53	+3.7	25	4,515	nw.	36	s.	19	0	7	23	7.9		
Colon	36	30	97	29.82	29.86	.....	79.8	.....	90	12	85	72	3	74	18	75	74	87	17.67	+5.0	22	5,464	se.	33	e.	25	3	11	16	7.7		
Alaska.																																	
Juneau	80	11	49	.....	.....	.....	50.5	.....	69	6	57	41	24	44	26	47	46	92	12.27	.....	19	3,209	s.	24	se.	18	8	2	20	7.1	.....	.....	.....

TABLE II.—*Accumulated amounts of precipitation for each 5 minutes, for the principal storms in which the rate of fall equaled or exceeded 0.25 inch in any 5 minutes, or 0.80 in 1 hour, during September, 1917, at all stations furnished with self-registering gages.*

Stations.	Date.	Total duration. From—	Total duration. To—	Total amount of precipitation.	Excessive rate. Began—	Excessive rate. Ended—	Amount before excessive rate began.	Depths of precipitation (in inches) during periods of time indicated. 5 min.	10 min.	15 min.	20 min.	25 min.	30 min.	35 min.	40 min.	45 min.	50 min.	60 min.	80 min.	100 min.	120 min.
Abilene, Tex	26			0.61														0.47			
Albany, N. Y	1			0.60														0.34			
Alpena, Mich	29			0.81														0.29			
Amarillo, Tex	14–15	5:15 p. m.	D. N. a. m.	1.08	5:44 p. m.	6:16 p. m.	0.01	0.05	0.17	0.29	0.38	0.48	0.53	0.59							
Anniston, Ala	27	2:46 p. m.	6:40 p. m.	1.02	3:38 p. m.	4:01 p. m.	0.06	0.25	0.42	0.65	0.74	0.78									
Asheville, N. C	21			0.64														0.57			
Atlanta, Ga	27–28	4:05 p. m.	6:30 a. m.	2.78	6:31 p. m.	7:31 p. m.	0.36	0.09	0.14	0.19	0.23	0.32	0.51	0.64	0.80	0.91	1.02	1.16			
Atlantic City, N. J	8			1.59														0.45			
Augusta, Ga	9	4:30 p. m.	6:20 p. m.	0.76	5:22 p. m.	5:33 p. m.	0.13	0.29	0.59	0.62											
		6:15 p. m.	10 00 p. m.	2.32	6:58 p. m.	7:37 p. m.	0.11	0.23	0.54	0.68	0.92	1.06	1.15	1.26	1.33						
Baker, Oreg	13			0.29														0.17			
Baltimore, Md	7			0.72														0.46			
Bentonville, Ark	8			1.10														0.56			
Binghamton, N. Y	2			0.13														0.13			
Birmingham, Ala	1–2	4:43 p. m.	D. N. a. m.	2.83	6:18 p. m.	7:40 p. m.	0.46	0.24	0.49	0.69	0.86	0.99	1.05	1.06	1.09	1.14	1.27	1.42	1.62	1.68	
Bismarck, N. Dak	11			0.45														0.45			
Block Island, R. I	18			0.90														0.23			
Boise, Idaho	22			0.51														0.16			
Boston, Mass	18			1.10														0.31			
Buffalo, N. Y	1	D. N. a. m.	7:45 a. m.	0.88	2:58 a. m.	3:18 a. m.	0.12	0.14	0.30	0.46	0.53										
Burlington, Vt	20			0.69														0.31			
Cairo, Ill	8	2:50 a. m.	4:00 a. m.	0.64	2:58 a. m.	3:11 a. m.	0.01	0.27	0.47	0.56											
Canton, N. Y	9			0.52														0.23			
Charles City, Iowa	7			1.21														0.43			
Charleston, S. C	29			0.52														0.33			
Charlotte, N. C	1			0.89														0.50			
Chattanooga, Tenn	15–16	10 07 p. m.	7:12 a. m.	1.69	12:35 a. m.	1:24 a. m.	0.13	0.21	0.24	0.30	0.34	0.44	0.56	0.64	0.67	0.77	0.82				
Cheyenne, Wyo	25			0.36														0 13			
Chicago, Ill	7			0.89														0.33			
Cincinnati, Ohio	7	7:45 p. m.	D. N. p. m.	2.01	8 02 p. m.	8:19 p. m.	0.09	0 11	0 29	0.43	0 61										
					9:32 p. m.	10:31 p. m.	0.70	0 06	0 11	0.24	0.34	0.36	0.48	0.55	0.66	0.73	0.86	1.06			
	8	5:10 a. m.	7:30 a. m.	0.65	5:15 a. m.	5:35 a. m.	0.01	0.07	0 28	0.48	0.62										
Cleveland, Ohio	5–6	7:16 p. m.	5:00 a. m.	1.83	10 28 p. m.	10:35 p. m.	0.12	0.41	0.54												
Columbia, Mo	7			0.73														0.68			
Columbia, S. C	9	5:55 p. m.	7:00 p. m.	0.64	6.00 p. m.	6:18 p. m.	0.01	0.12	0.19	0.58	0.62										
Columbus, Ohio	7			0 26														0.14			
Concord, N. H	20			0.38														*			
Concordia, Kans	6			0.09														0 09			
Corpus Christi, Tex	5			0.30														0 30			
Dallas Tex	4			0.56														0.36			
Davenport, Iowa	5–6	10:10 p. m.	2:15 a. m.	1.07	11:24 p. m.	11:54 p. m.	0.04	0.10	0.19	0.25	0.31	0.48	0.81								
Dayton, Ohio	2-3			0 29														*			
Del Rio, Tex	21			0.49														0.18			
Denver, Colo	14			0 22														0.14			
Des Moines, Iowa	4			0.87														0 36			
Detroit, Mich	5			0 85														0 45			
Devils Lake, N. Dak	18			0 30														0.16			
Dodge City, Kans	26			0 24														0.13			
Dubuque, Iowa	7			0 97														0 28			
Duluth, Minn	8			0.82														0 36			
Eastport, Me	30			0.57														0.15			
Elkins, W. Va	3	7:28 a. m.	8:40 a. m.	0 71	7:28 a. m.	7:45 a. m.	0.00	0.40	0.56	0.65	0.69										
El Paso, Tex	17			0.33														0 24			
Erie, Pa	2			0.50														0 50			
Escanaba, Mich	14			0.67														0 23			
Eureka, Cal	21			0.64														0 24			
Evansville, Ind	6	9:10 p. m.	11:20 p. m.	1.71	9:22 p. m.	10:32 p. m.	0 01	0 18	0 33	0 33	0 34	0.40	0.53	0.59	0.67	0.68	0.70	0.89	1.55		
	7	12:15 a. m.	1:45 a. m.	0.87	12:29 a. m.	12:47 a. m.	0.02	0.22	0.39	0.56	0.62										
Flagstaff, Ariz	10			0.85														*			
Fort Smith, Ark	26–27	8:57 p. m.	5:12 a. m.	0.96	9:08 p. m.	9:32 p. m.	0.03	0.13	0.34	0.49	0.60	0.63									
Fort Wayne, Ind	7			0.26														0.12			
Fort Worth, Tex	26	4:13 p. m.	10:30 p. m.	1.43	4:20 p. m.	4:39 p. m.	0.01	0.30	0.50	0.86	0.96										
Fresno, Cal	5			T.														T.			
Galveston, Tex	3	7:03 a. m.	11:30 a. m.	0.69	7:55 a. m.	8:19 a. m.	0.03	0 11	0.24	0.40	0.50	0.62									
	4	7:15 a. m.	12:15 p. m.	0.85	9:10 a. m.	9:25 a. m.	0.01	0.22	0 38	0.57											
	16	7:03 a. m.	11:45 a. m.	0.68	10:44 a. m.	11:08 a. m.	0.14	0.15	0.29	0.36	0.43	0.51									
Grand Haven, Mich	5			1.65														0.41			
Grand Junction, Colo	11			0.64														.24			
Grand Rapids, Mich	5	8:17 p. m.	11:00 p. m.	1.24	8:36 p. m.	8:56 p. m.	0.14	0.36	0.76	0.86	0.95										
Green Bay, Wis	5			0.84														0.46			
Hannibal, Mo	26			0.91														0.40			
Harrisburg, Pa	2	5:09 p. m.	5:40 p. m.	0.92	5:16 p. m.	5:34 p. m.	0.01	0.31	0.53	0.80	0.90										
Hartford, Conn	18			0.62														0.19			
Hatteras, N. C	3	3:15 p. m.	4:15 p. m.	0.58	3:17 p. m.	3:32 p. m.	0.01	0.22	0.42	0.55											
	10	4:43 a. m.	10:45 a. m.	2.20	6:11 a. m.	7:00 a. m.	0.19	0.06	0.11	0.23	0.39	0.51	0.60	0.68	0.76	0.83	0.91				
	14	9:15 a. m.	11:58 a. m.	1.98	10:23 a. m.	11:23 a. m.	0.13	0.07	0.15	0.21	0.32	0.58	0.97	1.16	1.38	1.44	1.46	1.68			
	14–15	2:45 p. m.	7:30 a. m.	4.37	6:42 a. m.	7:22 a. m.	3.10	0.09	0.20	0.45	0.66	0.90	1.09	1.20	1.25						
	29	10:40 a. m.	D. N. p. m.	1.89	7:55 p. m.	8:28 p. m.	0.76	0.16	0.31	0.39	0.47	0.50	0.58	0.64							
Havre, Mont	24			2.30														0.35			
Helena, Mont	14			0.37														0.17			
Houghton, Mich	13			0.70														0.22			
Houston, Tex	10	1:35 p. m.	5:22 p. m.	1.39	1:50 p. m.	2:25 p. m.	0.05	0.13	0.32	0.53	0.68	0.82	0.97	1.14							
Huron, S. Dak	25			0.60														0 41			
Independence, Cal	4			T.														T.			
Indianapolis, Ind	2–3	6:36 p. m.	D. N. a. m.	1.41	6:40 p. m.	7:07 p. m.	0.01	0.12	0.49	0.78	0.99	1.09	1.12								
Iola, Kans	26			1.02														0.49			
Jacksonville, Fla	10	3:05 p. m.	7:45 p. m.	0.93	3:16 p. m.	3:41 p. m.	0.01	0.15	0.27	0.38	0.43	0.50									
Kalispell, Mont	23			0.39														0.17			
Kansas City, Mo	25–26			2.46														0.65			
Keokuk, Iowa	3	3:05 a. m.	5:20 a. m.	2.55	4:02 a. m.	5:14 a. m.	0.28	0.17	0.40	0.83	1.13	1.39	1.63	1.81	1.82	1.83	1.85	1.99	2.27		
Key West, Fla	9	8:20 a. m.	11:15 a. m.	1.32	8:32 a. m.	9:03 a. m.	0.04	0.06	0.25	0.66	0.91	1.07	1.17	1.18							
	19	4:00 p. m.	4:40 p. m.	0.52	4:00 p. m.	4:22 p. m.	0.00	0.27	0.30	0.30	0.44	0.50									
Knoxville, Tenn	9	12:30 p. m.	2:00 p. m.	1.12	12:42 p. m.	1:06 p. m.	0.01	0.15	0.33	0.54	0.77	0.83									
La Crosse, Wis	19			1.68														0.41			
Lander, Wyo	5			0.03														0.03			
Lansing, Mich	5	5:10 p. m.	D. N. p. m.	2:58	7:09 p. m.	7:54 p. m.	0.02	0.08	0.17	0.31	0.33	0.34	0.40	0.56	0.72	0.86					
					8:34 p. m.	9:37 p. m.	0.93	0.08	0.28	0.41	0.49	0.53	0.77	0.86	0.95	0.95	0.97	1.54	1.61		
Lewiston, Idaho	22			0.20														0.17			

* Self-register not in use. † Record partly estimated. ‡ No precipitation occurred during the month.

TABLE II.—*Accumulated amounts of precipitation for each 5 minutes, for the principal storms in which the rate of fall equaled or exceeded 0.25 inch in any 5 minutes, or 0.80 in 1 hour, during September, 1917, at all stations furnished with self-registering gages*—Continued.

Stations.	Date.	Total duration.		Total amount of precipitation.	Excessive rate.		Amount before excessive rate began.	Depths of precipitation (in inches) during periods of time indicated.													
		From—	To—		Began—	Ended—		5 min.	10 min.	15 min.	20 min.	25 min.	30 min.	35 min.	40 min.	45 min.	50 min.	60 min.	80 min.	100 min.	120 min.
Lexington, Ky	7	2:55 p. m.	4:30 p. m.	0.68	3:13 p. m.	3:42 p. m.	0.01	0.22	0.31	0.31	0.31	0.55	0.65	.....	.....	.....	.....	.....	.....	.....	.....
Lincoln, Nebr	6–7	10:15 p. m.	1:00 a. m.	1.47	11:23 p. m.	11:52 p. m.	0.16	0.12	0.26	0.55	0.98	1.22	1.28	.....	.....	.....	.....	.....	.....	.....	.....
Little Rock, Ark	15–16	.....	.....	0.17	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	0.07	.....	.....	.....
Los Angeles, Cal	28	.....	.....	T.	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	T.	.....	.....	.....
Louisville, Ky	7	5:20 p. m.	7:45 p. m.	1.56	5:23 p. m.	5:52 p. m.	0.01	0.13	0.39	0.61	1.01	1.18	1.42	.....	.....	.....	.....	.....	.....	.....	.....
Ludington, Mich	5	.....	.....	0.58	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	0.24	.....	.....	.....
Lynchburg, Va	3	4:50 p. m.	6:20 p. m.	0.84	5:04 p. m.	5:36 p. m.	0.02	0.29	0.50	0.55	0.62	0.68	0.74	0.78	.....	.....	.....	.....	.....	.....	.....
Macon, Ga	4	1:10 p. m.	3:00 p. m.	0.66	2:28 p. m.	2:50 p. m.	0.08	0.15	0.22	0.39	0.52	0.58	.....	.....	.....	.....	.....	.....	.....	.....	.....
Madison, Wis	5	.....	.....	0.68	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	0.41	.....	.....	.....
Marquette, Mich	30	.....	.....	0.45	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	*	.....	.....	.....
Memphis, Tenn	1	3:20 p. m.	3:58 p. m.	0.54	3:41 p. m.	3:57 p. m.	0.01	0.26	0.37	0.51	0.53	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Meridian, Miss	9	.....	.....	1.17	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	*	.....	.....	.....
Miami, Fla	11	2:33 p. m.	4:55 p. m.	0.68	2:36 p. m.	3:04 p. m.	0.01	0.10	0.22	0.30	0.42	0.52	0.56	.....	.....	.....	.....	.....	.....	.....	.....
	15–16	7:10 p. m.	6:40 a. m.	2.39	7:33 p. m.	8:39 p. m.	0.03	0.11	0.24	0.33	0.42	0.44	0.46	0.50	0.54	0.57	0.65	1.02	1.24	.....	.....
	16	3:33 p. m.	9:25 p. m.	1.99	3:57 p. m.	4:38 p. m.	0.10	0.13	0.36	0.52	0.57	0.64	0.78	0.87	0.98	1.01	.....	.....	.....	.....	.....
	17	12:02 p. m.	1:50 p. m.	0.93	12:07 p. m.	12:43 p. m.	0.03	0.17	0.37	0.46	0.49	0.52	0.62	0.70	0.74	.....	.....	.....	.....	.....	.....
	25	5:26 p. m.	8:40 p. m.	3.98	5:28 p. m.	6:18 p. m.	0.01	0.15	0.18	0.38	0.69	1.16	1.55	1.61	1.69	1.87	1.90	.....	.....	.....	.....
					6:18 p. m.	7:08 p. m.	.....	1.90	1.92	2.26	2.44	2.46	2.47	2.48	2.60	2.72	2.75	.....	.....	.....	.....
					7:08 p. m.	7:58 p. m.	.....	2.83	2.83	2.85	2.86	2.87	2.96	3.08	3.50	3.78	3.84	.....	.....	.....	.....
					7:58 p. m.	8:09 p. m.	.....	3.86	3.94	3.96	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Milwaukee, Wis	5	D. N. a. m.	10:00 a. m.	1.68	7:49 a. m.	8:52 a. m.	0.58	0.06	0.14	0.20	0.24	0.29	0.35	0.38	0.43	0.50	0.56	0.89	1.08	.....	.....
Minneapolis, Minn	12	10:05 a. m.	8:30 p. m.	1.00	10:40 a. m.	11:07 a. m.	0.07	0.11	0.26	0.35	0.42	0.45	0.51	.....	.....	.....	.....	.....	.....	.....	.....
Mobile, Ala	16	8:55 p. m.	D. N. a. m.	1.25	9:11 p. m.	9:34 p. m.	0.03	0.10	0.35	0.52	0.56	0.60	.....	.....	.....	.....	.....	.....	.....	.....	.....
Modena, Utah	21	.....	.....	0.58	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	0.20	.....	.....	.....
Montgomery, Ala	1	8:45 p. m.	D. N. p. m.	0.86	9:32 p. m.	9:48 p. m.	0.01	0.20	0.52	0.59	0.61	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
	27	12:50 p. m.	3:40 p. m.	1.30	2:30 p. m.	3:07 p. m.	0.25	0.12	0.34	0.39	0.40	0.49	0.70	0.96	1.03	.....	.....	.....	.....	.....	.....
	27	6:24 p. m.	6:55 p. m.	0.87	6:24 p. m.	6:38 p. m.	0.00	0.15	0.63	0.84	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Moorhead, Minn	7	.....	.....	0.24	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	0.15	.....	.....	.....
Mount Tamalpais, Cal	22	.....	.....	0.16	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	0.07	.....	.....	.....
Nantucket, Mass	28	.....	.....	0.44	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	0.31	.....	.....	.....
Nashville, Tenn	27	.....	.....	1.13	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	0.30	.....	.....	.....
New Haven, Conn	18	.....	.....	0.79	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	0.25	.....	.....	.....
New Orleans, La	15	.....	.....	1.29	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	0.59	.....	.....	.....
New York, N. Y	1	6:35 a. m.	1:20 p. m.	1.72	9:45 a. m.	11:05 a. m.	0.46	0.06	0.14	0.20	0.33	0.45	0.53	0.61	0.66	0.69	0.73	0.81	1.14	.....	.....
Norfolk, Va	1	.....	.....	0.54	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	0.54	.....	.....	.....
Northfield, Vt	19–20	.....	.....	0.42	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	*	.....	.....	.....
North Head, Wash	9	.....	.....	0.39	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	*	.....	.....	.....
North Platte, Nebr	24	.....	.....	0.74	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	0.13	.....	.....	.....
Oklahoma, Okla	26	.....	.....	1.21	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	0.51	.....	.....	.....
Omaha, Nebr	15	.....	.....	0.21	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	0.41	.....	.....	.....
Oswego, N. Y	1	.....	.....	0.47	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	0.21	.....	.....	.....
Palestine, Tex	3	5:00 p. m.	10:25 p. m.	1.47	5:05 p. m.	5:30 p. m.	0.02	0.19	0.50	0.63	0.68	0.74	.....	.....	.....	.....	.....	0.41	.....	.....	.....
Parkersburg, W. Va	6	.....	.....	0.65	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	0.54	.....	.....	.....
Pensacola, Fla	14	5:45 p. m.	11:50 p. m.	1.07	8:14 p. m.	8:44 p. m.	0.19	0.15	0.26	0.27	0.32	0.49	0.63	.....	.....	.....	.....	.....	.....	.....	.....
	16	8:20 p. m.	11:05 p. m.	1.12	8:30 p. m.	8:57 p. m.	0.02	0.14	0.37	0.63	0.81	0.92	0.97	.....	.....	.....	.....	.....	.....	.....	.....
Peoria, Ill	7	4:35 a. m.	9:00 a. m.	0.95	6:59 a. m.	7:18 a. m.	0.20	0.07	0.34	0.56	0.66	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Philadelphia, Pa	8	.....	.....	1.14	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	0.37	.....	.....	.....
Phoenix, Ariz	13	.....	.....	0.49	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	0.43	.....	.....	.....
Pierre, S. Dak	18	3:35 p. m.	5:50 p. m.	1.36	4:08 p. m.	4:33 p. m.	0.35	0.05	0.16	0.42	0.66	0.80	.....	.....	.....	.....	.....	.....	.....	.....	.....
Pittsburgh, Pa	6	2:50 a. m.	5:15 a. m.	0.81	3:47 a. m.	4:24 a. m.	0.06	0.11	0.19	0.24	0.41	0.50	0.52	0.63	0.66	.....	.....	.....	.....	.....	.....
Pocatello, Idaho	4	.....	.....	0.28	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	0.28	.....	.....	.....
Point Reyes Light, Cal	21	.....	.....	0.05	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	0.03	.....	.....	.....
Port Arthur, Tex	2	6:05 a. m.	1:35 p. m.	1.46	7:51 a. m.	8:27 a. m.	0.47	0.16	0.29	0.40	0.42	0.45	0.53	0.68	0.73	.....	.....	.....	.....	.....	.....
Port Huron, Mich	27	.....	.....	0.61	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	0.40	.....	.....	.....
Portland, Me	6	.....	.....	0.11	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	0.04	.....	.....	.....
Portland, Oreg	14	.....	.....	0.45	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	0.12	.....	.....	.....
Providence, R. I	18	.....	.....	1.02	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	0.32	.....	.....	.....
Pueblo, Colo	7	3:55 p. m.	4:55 p. m.	0.72	4:03 p. m.	4:31 p. m.	0.01	0.09	0.21	0.29	0.40	0.59	0.67	.....	.....	.....	.....	.....	.....	.....	.....
Raleigh, N. C	8	2:32 p. m.	5:20 p. m.	1.16	2:39 p. m.	3:02 p. m.	0.01	0.50	0.64	0.88	1.06	1.09	.....	.....	.....	.....	.....	.....	.....	.....	.....
Rapid City, S. Dak	16	.....	.....	0.35	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	0.33	.....	.....	.....
Reading, Pa	8	.....	.....	0.80	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	0.30	.....	.....	.....
Red Bluff, Cal	22	.....	.....	0.69	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	0.30	.....	.....	.....
Reno, Nev	22	.....	.....	T.	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	T.	.....	.....	.....
Richmond, Va	6	5:15 p. m.	8:50 p. m.	2.00	6:07 p. m.	7:13 p. m.	0.16	0.06	0.23	0.34	0.38	0.45	0.53	0.58	0.68	0.85	1.09	1.59	1.78	.....	.....
Rochester, N. Y	1	.....	.....	0.57	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	0.38	.....	.....	.....
Roseburg, Oreg	12	.....	.....	0.35	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	0.14	.....	.....	.....
Roswell, N. Mex	16	.....	.....	0.62	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	0.42	.....	.....	.....
Sacramento, Cal	22	.....	.....	0.50	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	0.32	.....	.....	.....
Saginaw, Mich	7	.....	.....	0.34	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	0.10	.....	.....	.....
St. Joseph, Mo	7	.....	.....	0.39	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	0.32	.....	.....	.....
St. Louis, Mo	7	7:15 p. m.	D. N. p. m.	1.42	8:33 p. m.	8:52 p. m.	0.34	0.19	0.57	0.81	0.93	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
St. Paul, Minn	12	.....	.....	1.05	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	0.50	.....	.....	.....
Salt Lake City, Utah	22	.....	.....	0.38	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	0.29	.....	.....	.....
San Antonio, Tex	4	.....	.....	0.33	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	0.33	.....	.....	.....
San Diego, Cal	10	.....	.....	T.	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	T.	.....	.....	.....
Sand Key, Fla	9	2:55 p. m.	4:00 p. m.	0.68	2:59 p. m.	3:20 p. m.	0.01	0.11	0.37	0.53	0.61	0.64	.....	.....	.....	.....	.....	.....	.....	.....	.....
	19	5:59 p. m.	7:15 p. m.	0.72	6:04 p. m.	6:29 p. m.	0.03	0.05	0.21	0.45	0.59	0.64	.....	.....	.....	.....	.....	.....	.....	.....	.....
	22	6:18 a. m.	7:24 a. m.	0.95	6:24 a. m.	7:04 a. m.	0.02	0.11	0.24	0.42	0.53	0.70	0.76	0.81	0.88	.....	.....	.....	.....	.....	.....
	24	3:42 a. m.	12:25 p. m.	3.13	7:12 a. m.	8:22 a. m.	0.53	0.05	0.20	0.40	0.64	0.92	1.10	1.26	1.41	1.63	1.68	1.88	2.12	.....	.....
Sandusky, Ohio	5–6	D. N. p. m.	7:45 a. m.	0.74	12:16 a. m.	12:46 a. m.	0.09	0.06	0.15	0.27	0.37	0.48	0.58	.....	.....	.....	.....	.....	.....	.....	.....
San Francisco, Cal	22	.....	.....	0.02	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	0.01	.....	.....	.....
San Jose, Cal	21	.....	.....	0.01	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	0.01	.....	.....	.....
San Luis Obispo, Cal	29	.....	.....	T.	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	T.	.....	.....	.....
Santa Fe, N. Mex	18	.....	.....	0.21	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	0.14	.....	.....	.....
Sault Ste. Marie, Mich	27	.....	.....	0.36	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	0.10	.....	.....	.....
Savannah, Ga	4	1:24 p. m.	5:45 p. m.	0.95	1:36 p. m.	1:55 p. m.	0.07	0.14	0.40	0.59	0.65	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Scranton, Pa	30	.....	.....	0.26	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	0.17	.....	.....	.....
Seattle, Wash	27	.....	.....	0.14	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	0.11	.....	.....	.....
Sheridan, Wyo	1	.....	.....	0.10	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	0.05	.....	.....	.....
Shreveport, La	4	7:03 p. m.	10:00 p. m.	1.24	7:07 p. m.	7:52 p. m.	0.01	0.10	0.16	0.23	0.35	0.46	0.56	0.69	0.81	0.87	.....	.....	.....	.....	.....
Sioux City, Iowa	18	.....	.....	0.50	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	0.45	.....	.....	.....
Spokane, Wash	13	.....	.....	0.22	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	0.10	.....	.....	.....
Springfield, Ill	4	.....	.....	0.30	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	0.18	.....	.....	.....
Springfield, Mo	8	D. N. a. m.	9:18 a. m.	2.13	5:25 a. m.	6:42 a. m.	0.22	0.17	0.32	0.35	0.43	0.60	0.75	0.92	1.05	1.15	1.26	1.43	1.69	.....	.....
	26	3:30 p. m.	8:15 a. m.	1.61	4:18 p. m.	4:44 p. m.	0.09	0.21	0.48	0.71	0.85	0.92	0.94	.....	.....	.....	.....	.....	.....	.....	.....
Syracuse, N. Y	9	.....	.....	0.19	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	0.14	.....	.....	.....
Tacoma, Wash	7	.....	.....	0.76	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	0.52	.....	.....	.....
Tampa, Fla	26	2:46 p. m.	3:27 p. m.	0.98	2:48 p. m.	3:12 p. m.	0.01	0.12	0.34	0.54	0.77	0.97	.....	.....	.....	.....	.....	.....	.....	.....	.....
	29	D. N. a. m.	5:20 a. m.	0.90	4:29 a. m.	4:50 a. m.	0.06	0.26	0.53	0.66	0.80	0.81	.....	.....	.....	.....	.....	.....	.....	.....	.....

* Self-register not in use. † Record partly estimated. ‡ No precipitation occurred during the month.

TABLE II.—*Accumulated amounts of precipitation for each 5 minutes, for the principal storms in which the rate of fall equaled or exceeded 0.25 inch in any 5 minutes, or 0.80 in 1 hour, during September, 1917, at all stations furnished with self-registering gages*—Concluded.

Stations.	Date.	Total duration. From—	Total duration. To—	Total amount of precipitation.	Excessive rate. Began—	Excessive rate. Ended—	Amount before excessive rate began.	Depths of precipitation (in inches) during periods of time indicated. 5 min.	10 min.	15 min.	20 min.	25 min.	30 min.	35 min.	40 min.	45 min.	50 min.	60 min.	80 min.	100 min.	120 min.
Tatoosh Island, Wash.	12			1.25														0.46			
Taylor, Tex.	3	4:54 p. m.	D. N. p. m.	1.63	5:12 p. m.	6:22 p. m.	0.05	0.09	0.15	0.19	0.28	0.37	0.46	0.49	0.56	0.66	0.76	1.08	1.35		
	5	3:28 p. m.	5:08 p. m.	1.14	3:32 p. m.	3:57 p. m.	0.01	0.06	0.44	0.76	0.98	1.07									
	10	3:43 p. m.	D. N. p. m.	0.66	3:47 p. m.	4:20 p. m.	0.01	0.11	0.16	0.28	0.38	0.46	0.53	0.58							
Terre Haute, Ind.	7			0.71														0.44			
Thomasville, Ga.	28			1.24														0.49			
Toledo, Ohio	7			0.72														0.33			
Tonopah, Nev.	22			0.09														0.08			
Topeka, Kans.	26	7:47 p. m.	3:30 p. m.	4.47	12:34 a. m.	1:04 a. m.	0.72	0.10	0.32	0.62	0.91	1.14	1.31								
Trenton, N. J.	1	D. N. a. m.	8:55 a. m.	1.60	7:58 a. m.	8:44 a. m.	0.60	0.06	0.10	0.28	0.50	0.66	0.75	0.86	0.90	0.96	0.99				
Valentine, Nebr.	16			0.81														0.47			
Vicksburg, Miss.	1			0.16														0.16			
Walla Walla, Wash.	10			0.40														0.16			
Washington, D. C.	7–8			0.59														0.29			
Wichita, Kans.	26			0.34														0.10			
Williston, N. Dak.	14			0.48														0.12			
Wilmington, N. C.	4	4:14 p. m.	5:50 p. m.	1.08	4:24 p. m.	4:55 p. m.	0.01	0.31	0.66	0.82	0.86	0.93	0.99	1.00							
	9	3:15 p. m.	6:45 p. m.	0.85	3:24 p. m.	4:04 p. m.	0.01	0.08	0.15	0.29	0.40	0.45	0.51	0.56	0.62						
	14	10:20 a. m.	D. N. a. m.	4.18	7:21 p. m.	8:29 p. m.	1.91	0.06	0.14	0.17	0.21	0.24	0.31	0.41	0.56	0.66	0.77	0.94	1.14		
Winnemucca, Nev.	5			T.														T.			
Wytheville, Va.	4			0.37														0.21			
Yankton, S. Dak.	18	3:10 p. m.	5:20 p. m.	1.66	3:55 p. m.	5:01 p. m.	0.17	0.11	0.29	0.55	0.70	0.85	0.99	1.01	1.03	1.14	1.21	1.34	1.49		
Yellowstone Park, Wyo.	14			0.63														*			

*Self-register not in use. † Record partly estimated. ‡ No precipitation occurred during the month.

TABLE III.—*Data furnished by the Canadian Meteorological Service, for September, 1917.*

Stations.	Altitude above M. S. L.* Jan. 1, 1916.	Pressure. Station, reduced to mean of 24 hours.	Pressure. Sealevel, reduced to mean of 24 hours.	Pressure. Departure from normal.	Temperature. Mean max.+ mean min.÷2.	Temperature. Departure from normal.	Temperature. Mean maximum.	Temperature. Mean minimum.	Temperature. Highest.	Temperature. Lowest.	Precipitation. Total.	Precipitation. Departure from normal.	Precipitation. Total snowfall.
	Feet.	*Inches.*	*Inches.*	*Inches.*	°*F.*	°*F.*	°*F.*	°*F.*	°*F.*	°*F.*	*Inches.*	*Inches.*	*Inches.*
St. Johns, N. F.	125	29.76	29.89	+0.02	55.5	+1.5	63.9	47.1	74	38	4.21	+0.50	.....
Sydney, C. B. I.	48	30.00	30.04	+ .03	57.8	+1.3	69.1	46.6	85	38	2.90	−0.38	.....
Halifax, N. S.	88	29.95	30.05	+ .01	55.9	−1.7	66.5	45.2	77	33	2.02	−1.69	.....
Yarmouth, N. S.	65	29.99	30.06	+ .01	53.0	−3.1	62.2	43.8	70	32	1.90	−1.55	.....
Charlottetown, P. E. I.	38	29.99	30.03	+ .02	56.4	−0.9	64.9	47.9	75	35	1.57	−1.83	.....
Chatham, N. B.	28	30.02	30.04	+0.04	54.9	−0.5	66.2	43.7	82	33	1.15	−1.56	.....
Father Point, Que.	20	30.00	30.02	+ .04	47.9	−2.5	54.9	41.0	66	30	1.13	−2.00	.....
Quebec, Que.	296	29.76	30.09	+ .08	53.2	−1.9	62.3	44.2	74	30	2.38	−1.29	.....
Montreal, Que.	187	29.89	30.09	+ .05	56.5	−1.9	64.9	48.1	75	38	1.53	−1.77	.....
Stonecliffe, Ont.	489	29.48	30.08	+ .05	56.6	+0.9	67.1	46.2	80	32	0.66	−2.62	.....
Ottawa, Ont.	236	29.84	30.10	+0.06	57.2	−0.2	68.6	45.9	81	32	1.30	−1.39	.....
Kingston, Ont.	285	29.81	30.12	+ .08	58.9	−1.1	68.2	49.7	75	36	1.40	−1.40	.....
Toronto, Ont.	379	29.72	30.12	+ .06	58.6	−0.4	69.3	47.9	81	36	0.65	−2.60	.....
White River, Ont.	1,244	28.76	30.08	+ .10	48.8	−1.5	60.3	37.4	76	24	1.53	−1.24	.....
Port Stanley, Ont.	592	29.50	30.14	+ .08	55.8	−3.7	66.0	45.6	75	32	2.27	−0.46	.....
Southampton, Ont.	656	29.42	.....	.....	56.9	−0.6	65.8	48.1	79	39	1.33	−1.61	.....
Parry Sound, Ont.	688	29.42	30.10	+0.07	56.1	+0.1	66.0	46.2	81	31	1.36	−2.31	.....
Port Arthur, Ont.	644	29.38	30.10	+ .12	52.8	+0.6	61.2	44.4	74	28	1.78	−1.70	.....
Winnipeg, Man.	760	29.22	30.05	+ .11	55.5	+3.0	66.1	44.8	81	30	1.93	−0.10	.....
Minnedosa, Man.	1,690	28.24	30.05	+ .11	54.4	+3.9	68.1	40.7	91	23	0.97	−0.39	.....
Qu'Appelle, Sask.	2,115	27.76	30.00	+0.08	54.6	+3.5	68.0	41.3	90	24	0.78	−0.55	.....
Medicine Hat, Alberta.	2,144	27.68	29.94	+ .02	57.2	+2.2	71.3	43.1	85	31	1.43	+0.25	.....
Swift Current, Sask.	2,392	29.42	29.97	+ .05	55.4	+2.3	69.7	41.2	90	29	1.46	+0.24	.....
Calgary, Alberta.	3,428	26.47	29.99	+ .07	52.5	+2.7	64.9	40.2	86	30	0.95	−0.41	.....
Banff, Alberta.	4,521	25.43	29.98	+ .05	48.9	+3.1	62.3	35.6	76	25	1.10	−0.57	.....
Edmonton, Alberta.	2,150	27.68	29.96	+0.06	51.9	+2.6	65.3	38.5	82	24	0.41	−0.92	.....
Prince Albert, Sask.	1,450	28.46	30.01	+ .11	54.0	+5.4	68.5	39.6	89	26	0.78	−0.50	.....
Battleford, Sask.	1,592	28.25	29.98	+ .08	55.5	+3.7	70.0	41.1	88	29	0.53	−0.72	.....
Kamloops, B. C.	1,262	28.75	30.04	+ .07	59.1	+1.7	72.4	45.9	87	36	0.25	−0.60	.....
Victoria, B. C.	230	29.78	30.03	+ .02	55.8	+1.0	61.7	49.9	76	46	1.06	−1.10	.....
Barkerville, B. C.	4,180	25.72	30.03	+0.05	43.8	−2.9	54.0	33.7	65	22	3.29	+0.38	.....
Hamilton, Bermuda.	151	29.92	30.08	+ .01	77.7	+0.3	82.8	72.6	87	69	7.94	+1.43	.....

*See Explanation of Tables in this REVIEW for July, 1917, p. 388.

Chart I. Hydrographs of Several Principal Rivers, September, 1917.

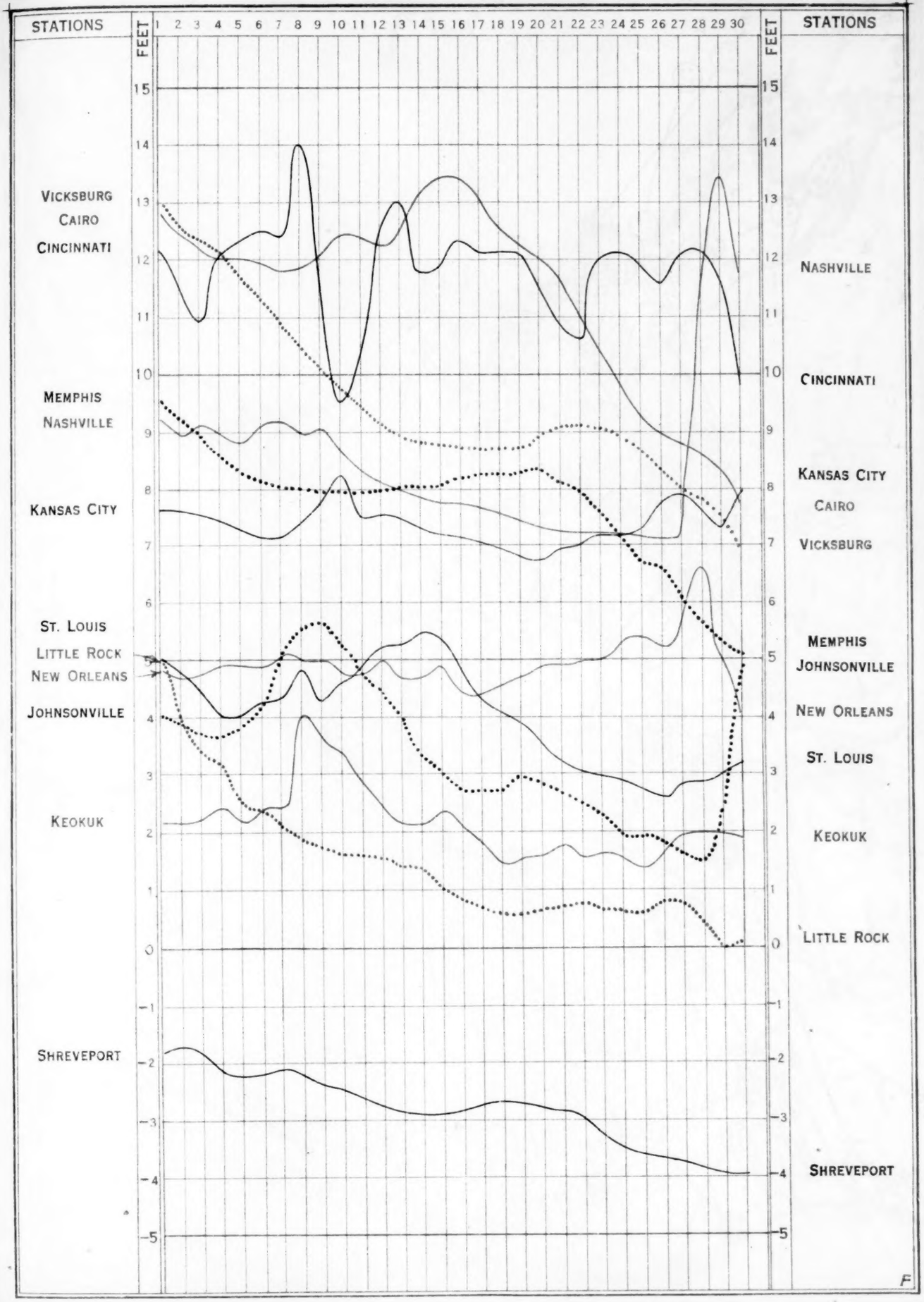


Chart II. Tracks of Centers of High Areas, September, 1917.

(Plotted by Charles A. Donnel.)

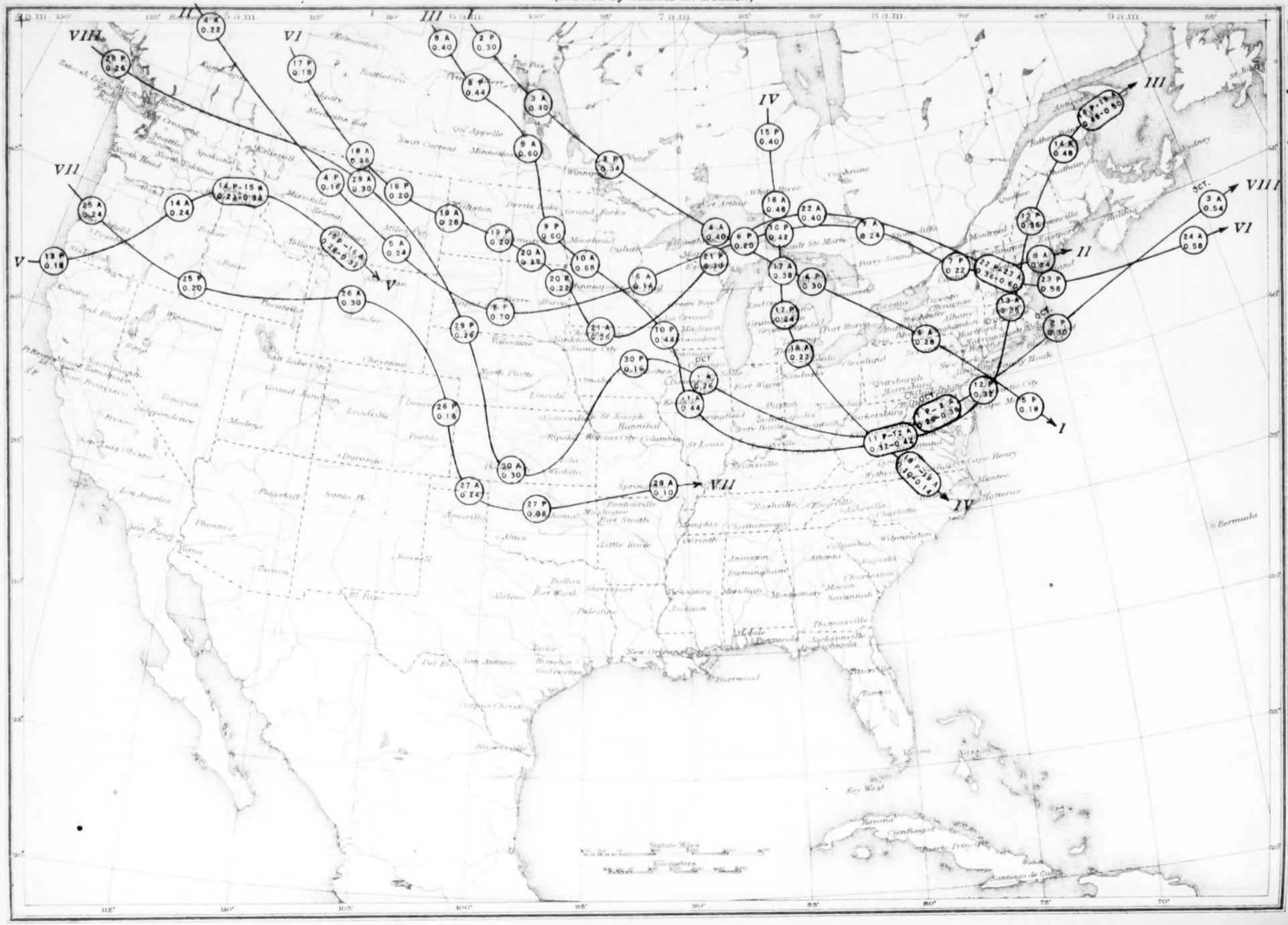


Chart III. Tracks of Centers of Low Areas, September, 1917.

(Plotted by Charles A. Donnel.)

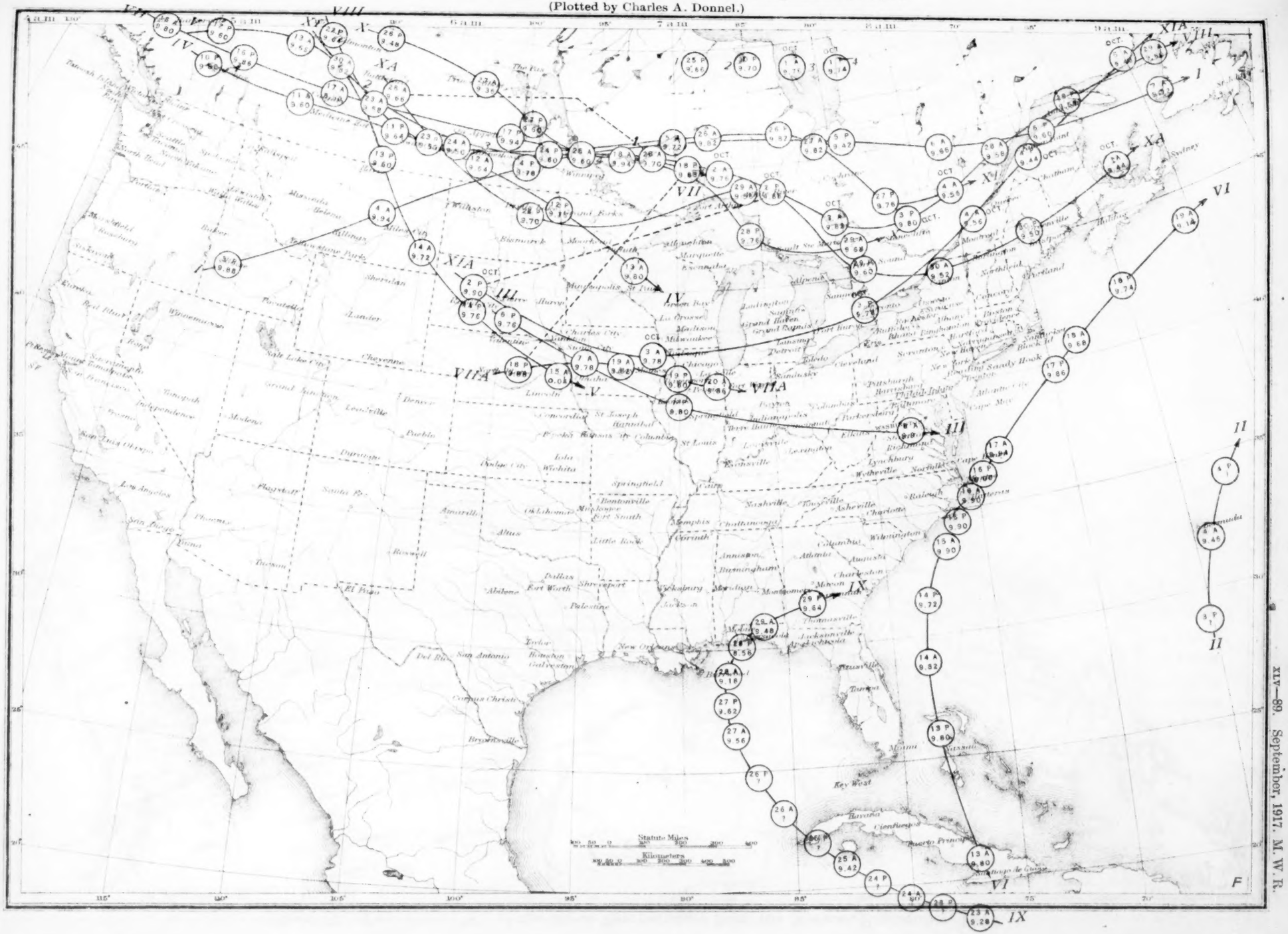


Chart IV. Departure (°F.) of the Mean Temperature from the Normal, September, 1917.

Chart V. Total Precipitation, September, 1917.

Chart V. Total Precipitation, September, 1917.

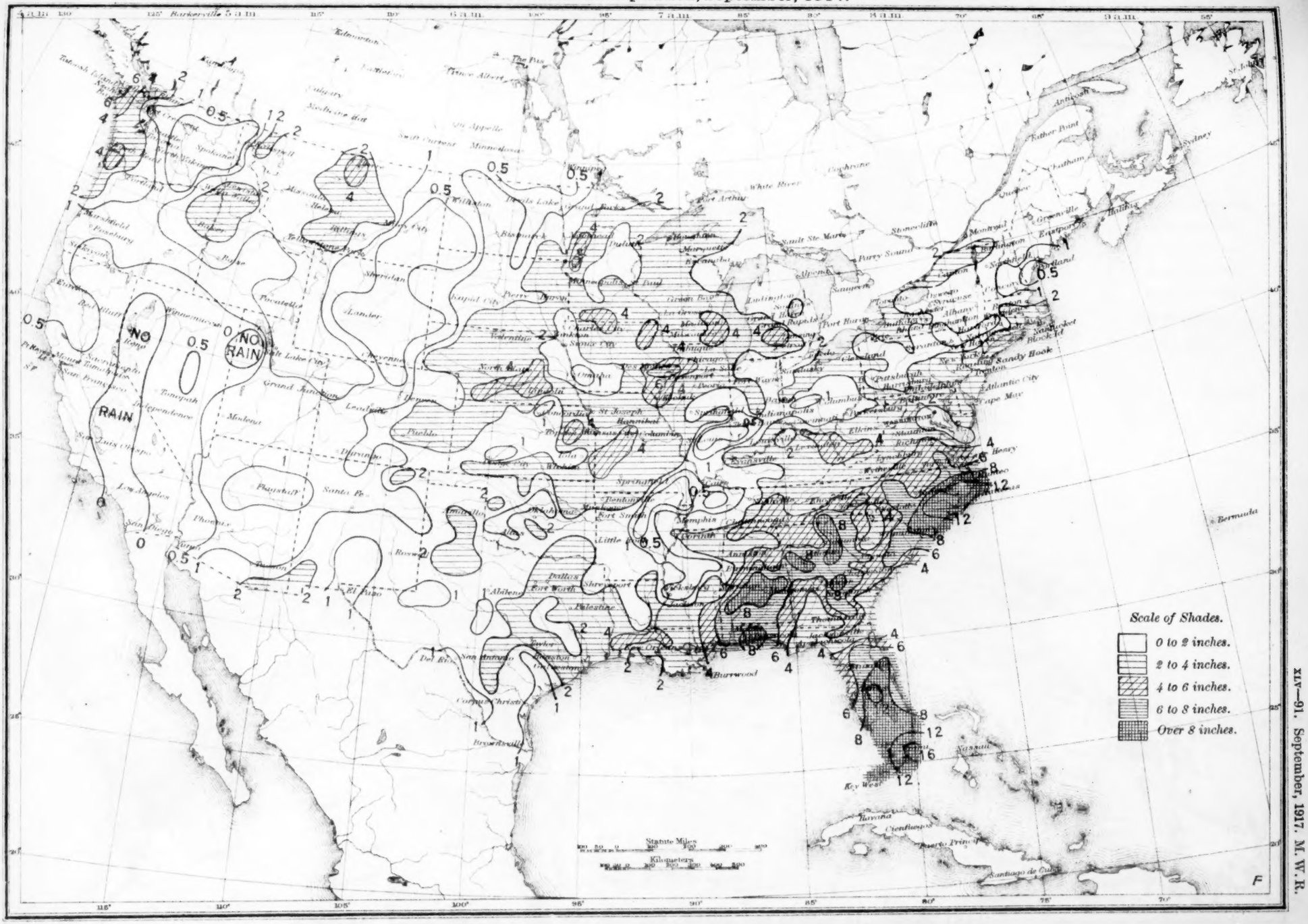


Chart VI. Percentage of Clear Sky between Sunrise and Sunset, September, 1917.

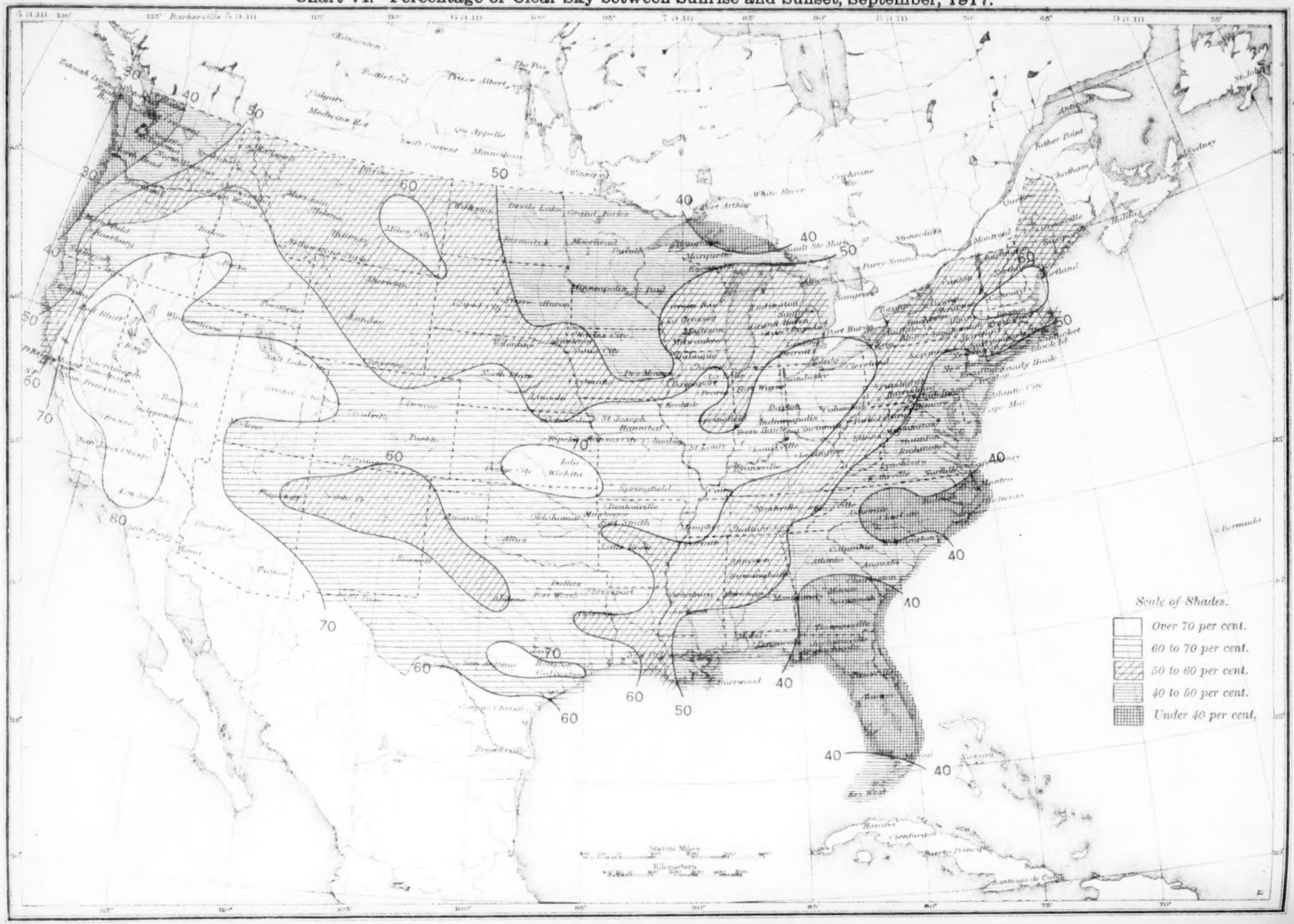


Chart VII. Isobars and Isotherms at Sea Level; Prevailing Winds, September, 1917.

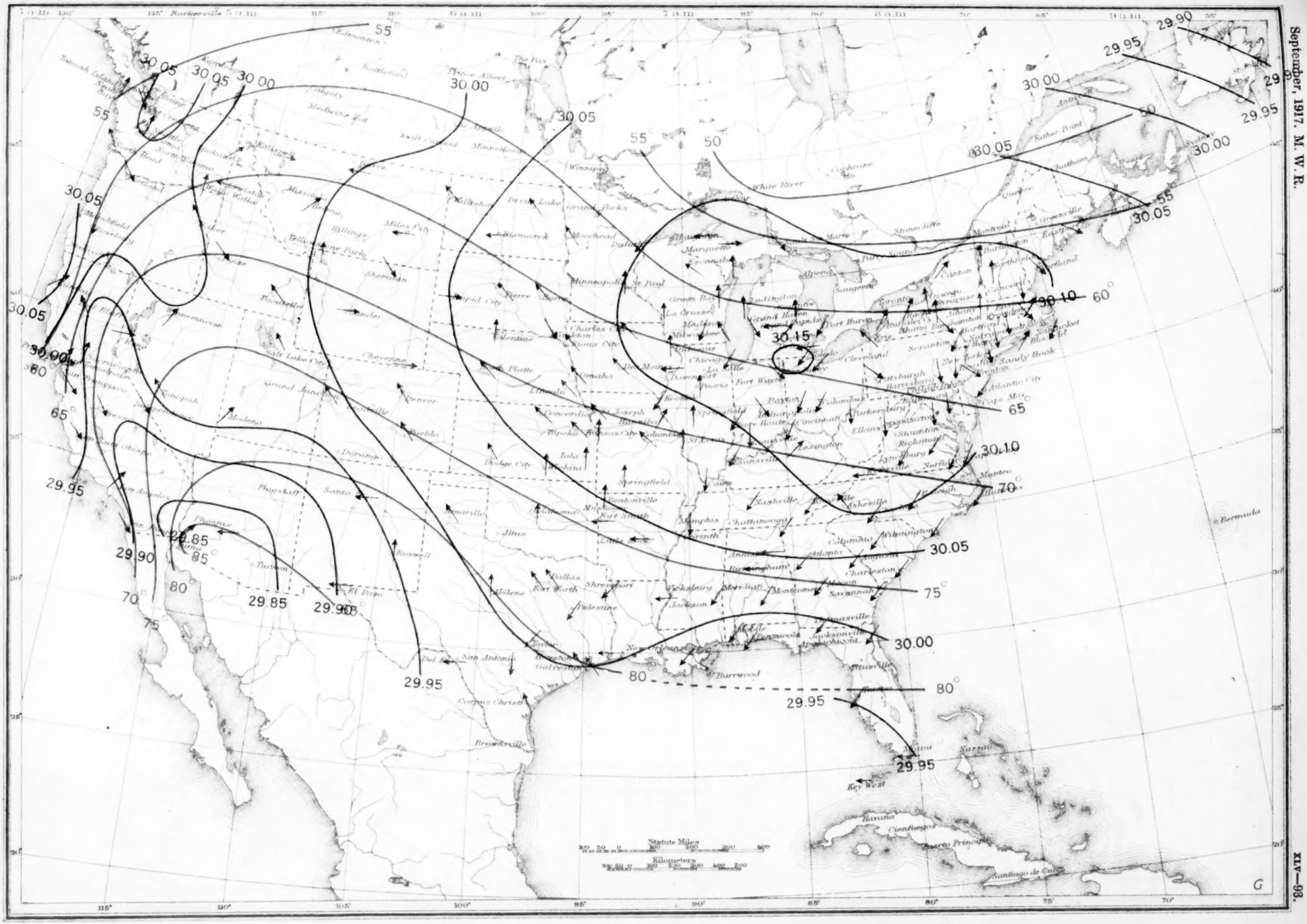
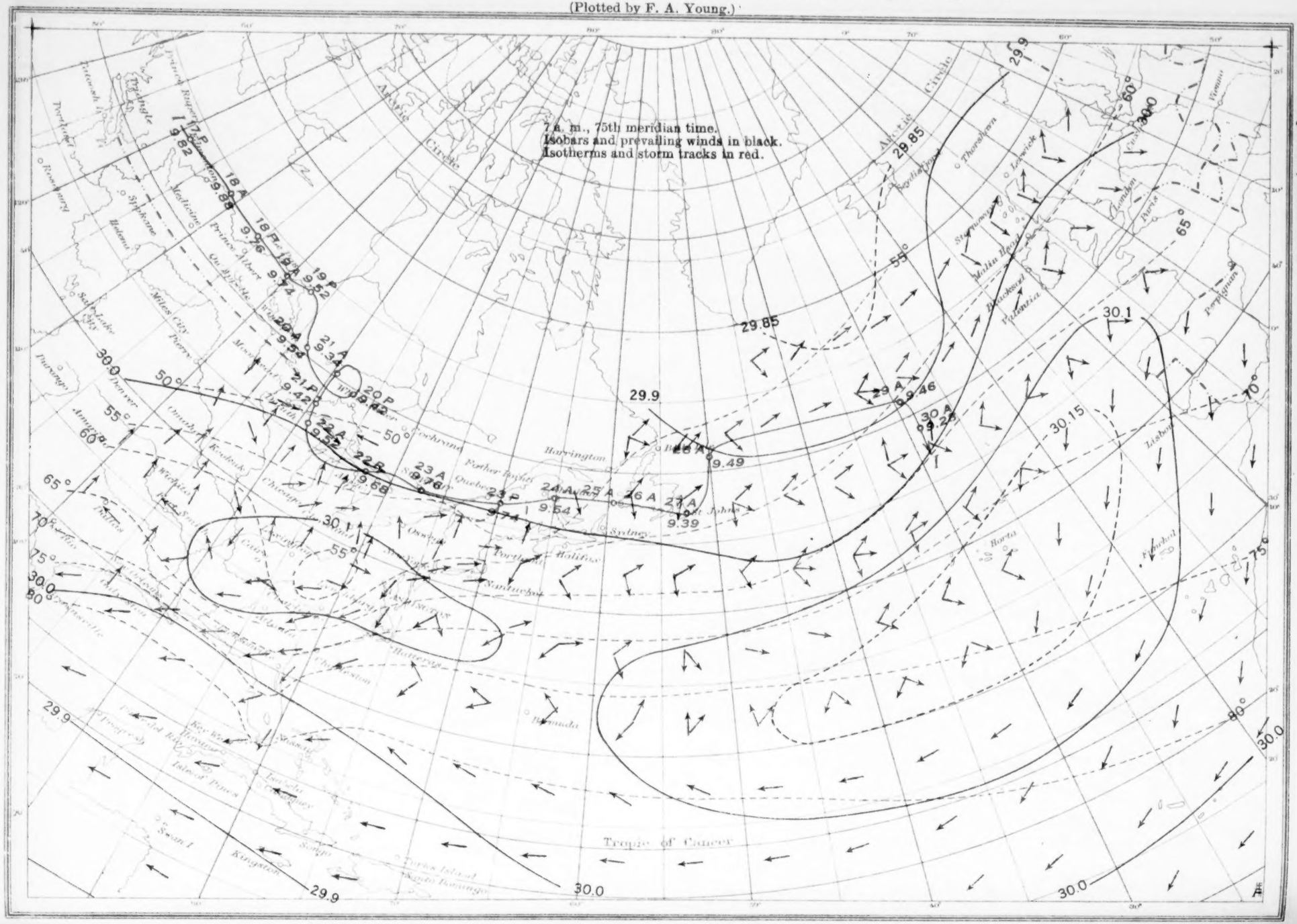


Chart IX. Means of Meteorological Data for North Atlantic Ocean, September, 1916.

(Plotted by F. A. Young.)


7 a. m., 75th meridian time.
Isobars and prevailing winds in black.
Isotherms and storm tracks in red.
Arctic Circle
Tropic of Cancer
Bermuda
Halifax
Quebec
Boston
Portland
Harrington
Yarmouth
Sydney
Port John
Kingston
Turks Island
Santo Domingo
Key West
Havana
Denver
Omaha
Chicago
Buffalo
Toronto
Lisbon
Gibraltar
Horta
Flores
Fayal
Madeira
Swan I
Prince Albert
Medicine Hat
Swift Current
Moosejaw
Qu'Appelle
Winnipeg
Port Arthur
Father Points
Escuminac
Cape Race
Sydney
Louisburg
Sable I
Yarmouth
Thorshavn
Lerwick
Stornoway
Malin Head
Blacksod
Valentia
Portpatrick
London
Paris
Lisbon
Gibraltar
Horta
Flores
Fayal
Madeira
Swan I
Kingston
Turks Island
Santo Domingo
Key West
Havana
Bermuda
Halifax
Quebec
Boston
Portland
Harrington
Yarmouth
Sydney
Port John
Cape Race
Sable I
Louisburg
Father Points
Escuminac
Port Arthur
Winnipeg
Qu'Appelle
Moosejaw
Swift Current
Medicine Hat
Prince Albert
Edmonton
Battleford
Calgary
Banff
Kamloops
Victoria
Seattle
Tatoosh I
Portland
Roseburg
San Francisco
Los Angeles
San Diego
Salt Lake City
Helena
Spokane
Miles City
Bismarck
Omaha
Denver
Amarillo
Abilene
Fort Worth
Galveston
Corpus Christi
Brownsville
Laredo
Eagle Pass
El Paso
Albuquerque
Santa Fe
Tucumcari
Oklahoma
Wichita
Dodge City
Concordia
Topeka
Kansas City
St. Louis
Springfield
Peoria
Chicago
Milwaukee
Grand Haven
Port Huron
Detroit
Toledo
Cleveland
Buffalo
Erie
Rochester
Oswego
Albany
Binghamton
Scranton
Harrisburg
Philadelphia
Atlantic City
Cape May
Baltimore
Washington
Hatteras
Cape Henry
Norfolk
Wilmington
Charleston
Savannah
Jacksonville
Tampa